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ABSTRACT

In this study, 1,500 men and women who were high school seniors in 1942 and 1943 and who competed in the first two annual Science Talent Searches for the Westinghouse Science Scholarship and Awards reported on their careers in 1957 in a brief questionnaire. Of these, 136 filled in a comprehensive supplementary questionnaire and were interviewed. Both samples included participants who had won honors and who had not won honors in the Science Talent Search. Among the findings of the study were: (1) students who stayed in science as a career came, on the average, from larger high schools than those who went into non-science careers; (2) teachers were a major factor in influencing the careers of students; (3) teachers' attitudes counted more than the subject matter which they presented; (4) students who became research scientists reported that their most influential teachers encouraged creativity and taught them a probing approach or gave them extra hours in the laboratory. (Author/BB)

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SCIENCE TALENT

Its Early Identification and Continuing Development

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and
Continuing Development

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FOREWORD

It is seldom that careers in science can be reviewed by comparing evidence obtained before the career was started with evidence obtained after the career was well launched.

This study summarizes current information on 1,550 men and women who were high school seniors in 1942 and 1943, and who competed in the first two annual Science Talent Searches for the Westinghouse Science Scholarship and Awards. All 1,550 reported on their careers in 1957 in a brief questionnaire. Of these, a representative selection of 136 filled in a comprehensive supplementary questionnaire, and further co-operated by meeting individually with an interviewer for several hours of additional detailed questioning and discussion. Both samples included participants who had won honors and who had not won honors in the Science Talent Searches.

The study and this preliminary report were made possible by Research Grant No. G3600 from the National Science Foundation to Science Service, Inc. Richardson, Bellows, Henry and Company, Inc., co-operated with Science Service, Inc., in conducting the research and preparing the report. The author has been associated with the Science Talent Searches since their inception, both in the development of screening procedures and in the selection of Winners and Honorable Mentions.

Thanks for contributing to this study are due to many persons: to Watson Davis, Director of Science Service and to members of the Science Service Staff, to those who conducted the interviews, to Dr. Herbert E. Krugman for preparing the draft of Section VI, to Mrs. Wanda Edgerton for coordinating the operation in general and for writing Section VII, to those Science Talent Search participants who replied to the brief questionnaire, and especially to the 136 who filled in the long questionnaire and, in the interview, reported on their career development.

SUMMARY

High school seniors who achieved the highest test scores on the Science Talent Search examinations administered annually by Science Service were most likely to attain higher degrees in college, according to a study which was made public today. The survey, titled "Science Talent, Its Early Identification and Continuing Development," was designed to determine how effective the Science Talent Search has been in identifying science talent.

Science Service, the non-profit institution for the popularization of science, has been conducting the Science Talent Search for the Westinghouse Science Scholarships and Awards since 1941.

The survey, included 1,550 high school seniors selected from the 6,656 who took the Science Talent Search examination and completed their entries in 1942 and 1943. Of those queried 1,234 were men, of whom 194 had won honors in the First or Second Annual Science Talent Search. Of the 316 women, 57 had won honors.

Among other findings of the study were these:

1. Students who stayed in science as a career came, on the average, from larger high schools than those who went into non-science fields. This suggests that there is a greater training potential or science sophistication in the larger schools.

2. Professors and teachers were a major factor in influencing the careers of all the students except those who became physicians. Generally it was indicated that the teachers' attitudes counted more than the subject matter which they presented. Students who later became research scientists reported that their most influential teachers encouraged creativity and taught them a probing approach, or gave them extra hours in the laboratory.

Students whose later professional careers were in industrial management prized the teachers who took a "hard facts" approach to learning.

3. Students who became physicians ranked family influences highest as factors in their choice of a profession.

4. The Science Talent Search contestants who became college professors said that they were influenced more by older brothers or friends of older brothers than by parents.

5. The women who were interviewed stated that schools and teachers had their effects as early as the second, third and fourth grades.

No Science Talent Search winner among those interviewed had changed his early choice of science as a profession, although some changed areas of science.

Science Service was enabled to make this survey through a grant from the National Science Foundation. The study was made under the direction of Dr. Harold A. Edgerton, who has been associated with the Science Talent Search since its inception in the development of screening procedures and selection of winners.

Dr. Edgerton states that the survey opens up many questions which should have future consideration. Among these are:

How many high school students who express a serious intent to follow a science career actually enter their chosen field?

What becomes of those who do not?

What influences women to choose science as a career? What obstacles do they encounter in college training, employment and career advancement because they are women?

Are there any clues as to physical, psychological or personality types, or different characteristics of behavior that add up to varying degrees of creativity?

One of the aims of Science Service is to investigate such problems connected with identifying the most talented American youth for careers in science.

Dr. Watson Davis, Director of Science Service, commenting on experiences in the Science Talent Search, says: "Much more money must be devoted to such studies if this nation is to meet the challenge of the Communist powers. Science Service and other similar agencies are still limited by the lack of availability of funds to follow properly all the channels of investigation opened up by this and other such studies. Even with the vast program of the 25,000 Science Clubs of America and the 750,000 students preparing exhibits for science fairs, many of the most capable young people are still being wasted because of the lack of early identification and proper guidance of their development."

I

INTRODUCTION

The annual Science Talent Search began in 1942, as an activity of the Science Clubs of America and of Science Service, Inc., a non-profit educational institution which sponsors Science Clubs of America. From its inception, cooperation and financial aid have been given by the Westinghouse Educational Foundation of the Westinghouse Electric Corporation. The purposes of the Search are to interest and encourage high school students toward a scientific career, to bring to public attention the valuable research potential in the youth of our country, and to create greater interest in science among young people through Science Clubs of America.

Objectives and Scope of this Survey

Continued effective administration of a program of this magnitude obviously calls for follow-up studies of results achieved. But beyond that, the urgent need to strengthen and maintain this country's scientific position makes it imperative to seek all possible light on such questions as:

1. How effective, in terms of later realization, have been the selection methods used in the Science Talent Searches? What further avenues are indicated for the identification of science talent among high school young people? Are there traits and experience responses which will indicate creative science talent at an earlier age?

2. What factors aid highly selected boys and girls in achieving satisfying and effective careers in science? What is likely to lead some of them into other fields?

3. What can be learned from the career and social patterns of people now established in scientific pursuits, or in other pursuits after scientific training, which will aid in the career choices of young people contemplating a life in science?

4. What can be gleaned from observations by these people as to what career changes they would make if they "had it all to do over again?" From advice which they would like to pass on to future STS participants?

The present study has been designed to seek answers - or at least directions to answers - to the above questions, supplementing earlier studies alluded to in the next Section, which have made use of voluminous data available on all participants in the annual Talent Search.

This study and report are preliminary in character, seeking primarily to explore and to outline hypotheses which must await testing in later, more definitive studies. While statistical analyses were made of responses to a broad preliminary questionnaire, as explained in our discussion of procedure (Section IV), this investigation was designed primarily around the technique of "interview in depth" among a much smaller group selected from the larger sample. Only in this way, through the sifting and assessment of individual information obtained in detail by personal contact, was it felt that sufficient insight could be secured into the highly important questions listed under Nos. 2 and 3 above - although the questionnaire results alone do give strong corroborative information regarding the validity of the selection methods mentioned in the first part of No. 1. While the case histories obtained by the interviews were relatively few in number, the variety of data is great, and enough differences were noted to make certain patterns emerge, at least as hypotheses for further consideration.

The data and career development histories for those who have participated in the Talent Searches through the years could constitute a remarkable single source of information for use in the later definitive study here contemplated. They need to be made more complete by extension of the present type of study, and to be examined more intensively for an integrated picture of the selection, educational, and environmental factors which can increase the quantity and quality of our scientists. The data used in the selection of Winners and Honorable Mentions in each annual Science Talent Search are available for study. The subsequent history of each individual needs to be added to give the career development data needed to help in finding answers to the questions of career development of scientific and technical persons.

II

BACKGROUND: THE ANNUAL SCIENCE TALENT SEARCH

Each year, seniors in the high schools of the continental United States compete for honors and scholarships in the annual Science Talent Search. Credentials upon which selections for honors are made include:

1. A Science Aptitude Examination

2. Anecdotal recommendations by teachers (e.g., "What did he do to show his resourcefulness?")

   This consists of a detailed report on the student indicating what specifically he had done, which demonstrated his degree of such characteristics as scientific attitude, resourcefulness, initiative, ability to work with others, inventiveness, and the like. Teachers were urged to report what the student had done rather than give unsubstantiated and glowing testimonials.

3. Transcript of High School Record, including a statement of the student's relative standing in his graduating class.

4. Report on "My Scientific Project."

   Each contestant submitted a report of about 1000 words in length telling of some scientific work he had done or was planning to do. For the first grap (STS-1) the topic was "How Science Can Help In Winning the War." The topic, "My Scientific Project" was used for the Second Annual Science Talent Search and in all subsequent years. Each report was evaluated in terms of what it seemed to reflect regarding the knowledge, application of knowledge, and creativity of the student.

Forty Winners are selected in each Search. In addition, each year 260 are named "Honorable Mentions."

Each of the Honorable Mentions received a certificate, and his school received a plaque. In addition, a list of all Honorable Mentions and Winners was sent to all colleges and universities of the United States, calling their attention to this supply of talent. The status of Honorable Mentions indicates students of very superior talent and promise and has been so recognized by colleges and universities in their scholarship awards.

All forty Winners attended a five-day Science Talent Institute in Washington, where they heard addresses by and discuss science problems with nationally and internationally famous scientists. At this time they are also able to make tours of scientific research agencies and institutions in the Washington area. At this time each of the Winners is interviewed by each of the judges. On the basis of the interviews and all of the other information regarding each Winner, scholarships were awarded.

In the First and Second Annual Science Talent Searches, whose participants are the subject of this report, more than 6,000 high school seniors from all states submitted credentials, indicating an intense interest in following science as a career. As of 1957, when the present study was begun, 680 Winners, boys and girls, had been selected in the seventeen successive annual Searches. In addition, a total of 4,420 achieved Honorable Mention. There were over 40,000 others who competed with the 5,100 for honors. These also were young people of ability, urged by their teachers to enter the competition.

Previous Studies of STS Participants*

Records of all participants in the annual Science Talent Search have been preserved. In addition, a two-page follow-up questionnaire was sent annually to all participants of the first two Searches for whom addresses were available from 1943 to 1951.

The information for the first three years was coded and put on IBM cards. From these data, two Ph.D. dissertations (Ohio State University) were written. One of these studies (15) compared the achievements and events reported by the "Honors" group with the similar data for those who had won no Honors. The second (17) was aimed at finding if the difference in later achievement of those who won Honors and those who won no Honors could have been accounted for by motivations stemming from the awards and public acclaim.

A third study (11), also an Ohio State University Ph.D. dissertation, was concerned with the evaluation of anecdotal records of the achievements of the contestants.

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*A selected bibliography of studies relating to the Annual Science Talent Searches is presented as Appendix VII.

Results of the several studies of the Science Talent Search participants included three kinds of pertinent information:

1. An aggregate summary of achievements and activity in growing as scientists; e. g., publications, per cent who earned advanced degrees, kinds of persons and events which appeared to be influential, discoveries and new concepts developed, changes from one field to another.

2. The relationships of status in the Science Talent Search to educational and economic indices, with some discussion of the implications for creating and nurturing science talent.

3. A more personal, individual picture of the lives, problems, and achievements of young scientists during their college and early professional years.

In general, these studies cast a favorable light on the Talent Search. For example, In the first three years following college studies showed (13, 15) that of the Winners (94%) and Honorable Mentions (87%) and Others (76%) started to college. Despite war conditions, these per cents for the third year after graduation were 79%, 73% and 54% respectively. The Winners and Honorable Mentions reported higher average marks than did the Others, and it must be noted that the average marks for the Others group was B. In addition, the Honors group were distinctly superior to the Others group in per cents having membership in honorary societies, and in scholarships and fellowships awarded.

III

SUMMARY OF FINDINGS

Here we highlight the information obtained from the 1, 550 high school seniors of 1942 and 1943 who reported on their careers in 1957, and of whom 136 were later interviewed.*

Of the larger sample, 1, 234 were men, of whom 194 had won honors in the First or Second Annual Science Talent Search, and 1, 040 had won no honors; 316 were women, of whom 57 had won honors, and 259 had not.

The interview sample contained 105 men and 31 women, of whom respectively, 48 and 16 had won honors.

Within the confines of the restricted sample sizes that could be reached in the present work, which, certainly as far as the interviews are concerned, limits us to indicative results rather than to statistically validated ones, let us see what inference can be drawn against the four sets of questions listed under broad objectives.

A. Identification of Science Talent

1. Statistical evidence that selection for honors was valid if contained in the record of later academic achievement, based on the larger sample. In general, the higher the academic degree, the higher the test scores of those who attained that degree. Moreover, a higher proportion of those who won honors in the Science Talent Search obtained doctorate degrees than did the non-honors participants who had equivalent Science Aptitude Test Scores.

2. There is a relationship between the Science Aptitude Test score and choice of field of science. This was apparent as of the time of the Search (high school graduation) and is even more clearly drawn 15 years later in terms of the fields

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*The brief questionnaire is given in Appendix I. The comprehensive questionnaire sent to all who were interviewed is given in Appendix II. References to tables supporting statistical results quoted are given in the later sections discussing findings in detail.

actually entered. On the average, those who wanted to become physicists and chemists had better test scores than those desiring other fields. Those who in 1957 had become chemists and physicists, on the average, had higher test scores than those who went into other fields of science.

In terms of new directions, this indicates the practicability of further work in construction of test batteries to predict probability of success in specific fields of science.

3. Of the 1, 550 only 8% were in 1957 clearly identified with research. It is interesting to note that 18% of the male Honors group are thus identified, as against only 8% of the male Others group. The corresponding percentages for women are 5% and 2%. This again supports the validity of the selection.

4. There is a substantial correspondence between choice of field as high school seniors and actual occupational field 15 years later. In 1957, 30% of the large sample group were in the same field they had announced as theirs in 1942 and 1943. This would indicate that whatever the underlying influences, it was possible for those making these choices, to identify in themselves (albeit with the stimulation of teachers and others which may well have been made more explicit by the STS competition) a particular bent which was later realized in achievement.

5. It was intended that the probing interview should throw significant light, one way or the other, on the so-called "Roe hypothesis" having to do with the relation of adult attitudes and interests to experiences and "emotional climate" in the very earliest childhood.* As it turned out, no conclusive results on this question could be garnered in the time available to the interviewers, and so this aspect of our subject must hopefully be earmarked for the special and comprehensive study which its importance warrants.

6. Despite the above, some distinctive differences appeared, worth noting. The physicians frequently were interested in chemistry,

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* A condensation of the paper by Dr. Anne Roe, setting forth this hypothesis, with special reference to early motivation of scientists, appears in Appendix III. The paper itself was furnished to all interviewers.

zoology, and even engineering at earlier ages, but also wanted to work with people. On the other hand, the researchers were not people-oriented, reporting childhood isolation from other children, and turned to books and laboratories or fled there to escape people problems. Those who are now industrial managers, rather than in scientific work, were competitive and people-oriented and (anticipating here the question of career development) were influenced more by associates, supervisors, and bosses.

7. When did present scientists know "science was for them?" A considerable variation among the interviewees showed up here: Some were interested in science since early childhood, some in high school, others had only a moderate interest in high school, while chance jobs, military service, or other experience got them "on the track." Some said they could not remember when they had not been interested. In general, the interview results seem to support the observation by others that cultural environment, the kinds of toys, and the response to the kinds of play activities approved help set the stage for later vocational choice.

B. Factors Influencing Career Development

1. Of a larger sample those who stayed in science came on the average from larger high schools than those who went into non-science fields. This suggests the greater training potential or "science sophistication" of the larger schools.

2. Almost all of the men saw military service. (It must be noted that these men graduated from high school in 1942 and 1943.) Those who were interviewed reported that military service interfered little more than delaying their plans, had given them added maturity, and had provided G.I. Bill-of-Rights help without which some might not have gone to college.

3. Of the 105 men interviewed, influences on career choice and development were reported as follows:

   a. Professors and Teachers were a major influence on all occupational groups except physicians. Generally it was a teacher's attitude that counted more than his subject matter. The research men reported that their influential teachers encouraged creativity, taught them a probing approach, or gave them extra hours in the laboratory. The industrial managers prized the teachers who held high standards and had a "hard facts" approach.

b. For the physicians, family influences ranked first. Fathers or father substitutes who had been doctors were important. The research men reported early parental encouragement to find answers to their own questions. They were accepted in adult conversation, they were provided books and Bunsen burners. Most important, their parents gave them freedom and responsibility early and expected high achievement from them.

c. The present college professors were influenced more by older brothers or friends of older brothers than by parents.

d. The industrial managers gave more mention of a desire for better economic achievement than their parents. More in this group also had been separated from a parent before high school age through death or other circumstances.

4. Of the 31 women interviewed, influences on career choices and development were reported as follows:

   a. Schools and teachers had their effects as early as the second, third and fourth grades; not just the science teachers but those who encouraged and helped them realize their own potential.

   b. Family influences included early exposure to a brother's chemistry set, a father's workshop. Mostly it was a family climate that was conducive to collecting facts, to inventing, satisfying one's curiosity. Families in which learning was held in high regard were the rule.

   c. Six of the 14 women who won honors went on to a doctor's degree, while only one of the 15 non-honors did so.

5. Of the larger sample, only 8% of the men had left science, compared with 15% of the women who had done so. Half of these, not unexpectedly, had become homemakers. Why did some leave science? Reasons were given by twenty of the men interviewed who had left science: desire for money, lack of guidance. However, no STS winners were among those who changed their goal. The industrial management group most often reported a change

of occupational goal as a result of military experience. Among the women interviewed, marriage does not appear to have been a prime cause for leaving science. It was noted that the women with the higher degrees tended to continue working after marriage.

C, Career and Social Patterns of Established Scientists

1. The present kinds of employers of the 1, 550 sample in descending order of frequency are: business and industry, self-employed, colleges and universities, military service, government service, and high school teaching.

2. The largest proportion of participants holding a doctoral degree occurs, as one might expect, in medicine. The next largest proportion are those in the biological and physical sciences. The proportion of participants holding the doctorate degree in all fields is higher for men than for women, and higher for those in the Honors group than for those in the Others group.

3. Of the larger sample, 85% of the men are married as compared with the national 1958 average of 87% for their age group. Of the women, 78% are married, considerably below the 1958 average of 93% for their age group. Frequency of divorce is distinctly lower than that reported in studies which have been made of gifted men, and of biologists.

4. The men who were interviewed married a little later than men in the nation as a whole. Of this sample, the industrial management people married youngest, then physicians, then college professors. The research men were more likely to marry late. Physicians have the largest families.

5. As to women scientists and marriage: Throughout the interview of the 31 women directly contacted, of whom 20 were married and 11 single, there is a persistent expression that marriage is of first importance to fulfillment as a woman. About a third of those who were married have continued to build professional satisfaction on top of home responsibilities. Those who were single usually were happy in their jobs, but still found life incomplete and felt that marriage would be a desirable addition to or substitute for their job. Among those who are married, those who have higher degrees are more likely to continue to work professionally.

For 3 out of 5 of the married women, those who are working usually have husbands in the same or allied fields. Their husbands' support and encouragement is a most important influence in continuing their education after marriage. Marriage and sometimes children preceded their highest degree. All of them pointed to the need of husbands' support and encouragement in continuing a career on top of homemaking.

The problems of the dual role are considerable. Some reported that the science role sometimes erected an "egghead" barrier between them and their neighboring homemakers. Children helped establish a common area of interest.

They recognize that their husbands' job is of first importance, sometimes requiring moving which would be upsetting to their own job. Child bearing limited their professional work. The question of whether to stay home when the children are infants or to postpone the science career until later is often a question with them.

There are real satisfactions, however, in the dual role: a greater interest in work, a better opportunity to grow professionally with their husbands, and the anticipation of increasing time and interest in a job as needs of the growing-up family decrease.

Among those who are single there is no evidence that they have remained single out of dedication to science. Many expressed their desire for marriage, a possibility which becomes more remote as they advance in their professional competence and status.

D. Change if They "Had It to Do Over"... Advice to Future STSers.

1. In each group interviewed there were more who would, than who would not, make some change in their careers. This was especially true among researchers, both in medicine and in industry, and least true among physicians and college professors. However, while the specific changes mentioned were many, they rarely involved a change in vocation as such. Some light on attitudes may be thrown by replies to questions about their children becoming scientists. Many said "yes," and many said they would leave it up to the child. Few said "no."

2. A number of very general themes developed out of the interview questions on what advice they would like to give to future STS participants. Most common were such themes as "be broad" - perhaps more common among physicians and industrial managers; "take physics and math early" - more common among college professors and researchers in industry; and "don't go in unless you're sure, and don't make your choice of specialization too soon" - more common among college professors. Most of these advices seem to say that one should build his scientific specialization on a broad base.

IV

PROCEDURE

Procedural Steps in carrying on this study were as follows:

1. Prepare and mail a brief preliminary questionnaire to all participants in the first two annual Science Talent Searches for whom there were presumably good addresses.
2. Select 150 to be interviewed from those who returned the preliminary questionnaire.
3. Prepare both a preliminary interview schedule and a supplemental long questionnaire. The interview plan included the topics or areas to be covered, along with suggested probing questions designed to obtain answers in sufficient clarity and detail. A questionnaire, to be mailed to the interviewee and filled out prior to the interview, covered such information as schools attended, degrees earned, publications, family status, positions held, honors received, memberships in technical and professional societies, etc.
4. Interview a small sample (not drawn from the study sample) in order to try out and give a basis for improving both the schedule and the interviewing procedure.
5. Revise the interview plan and questionnaire.
6. Complete the interviews.
7. Analyze the data and prepare the report.

The forms, letters and instructions used are shown in Appendices I, II and III. Appendix I shows the letter and preliminary questionnaire which were sent the Large Sample. Appendix II shows the materials sent to the Interview Sample of 150, and Appendix III gives the names of the interviewers and materials sent to them.

Because of time and costs, little attempt was made to get in touch with either those whose questionnaires were returned marked "Addresses Unknown" or those who otherwise did not reply.

From the 1, 550 who returned the short questionnaire, 150 were selected for interview and asked to fill in a longer supplementary questionnaire. Factors considered in the selection of this smaller group are discussed in the following paragraphs. Interviews were completed with 136 of this 150.

Selection of the Larger Sample

Participants in the First and Second Annual Science Talent Searches (STS-1 and STS-2) were adopted as the larger sample for this study. The factor most pertinent in this decision was that those STS participants had had the longest time in which to establish themselves in careers and from that point of view offer the most information about career and professional development. These participants graduated from high school in 1942 and in 1943. On the other hand, they could be considered a "normal" or random sample of participants in these annual Science Talent Searches. They were a first group, and the reputation and status of the Science Talent Search had little influence in their participation. Selection techniques have been improved in subsequent Searches. War conditions may have produced different career development patterns on these participants than on those of the postwar years.

The early stages of career development of these STS participants had been studied and reported. At that time a bias in the sample of participants who answered follow-up questionnaires was noted (14); those who replied to the questionnaire had on the average, higher Science Aptitude Test scores than those who did not respond. It is assumed that that same kind of bias would be present in this study.

The first step was to investigate the present addresses of the STS-1 and STS-2 participants. This was done by mailing a brief six question questionnaire to all the participants in the First and Second Annual Science Talent Searches for whom there were addresses as of 1950. A total of 5, 330 questionnaires were mailed. This questionnaire was a single sheet of paper. On one side was a letter describing briefly the purpose of this study and asking their cooperation. The other side contained the questionnaire. A postage paid return envelope was provided.

First class postage was used in mailing the questionnaire so that all undelivered mailings would be returned.

Table IV-1* shows the number of questionnaires mailed out (5, 330) and the number returned (1, 550). The per cent of returns was higher for men (31%) than for women (24%). This may be due to identity changes of the women by marriage. As one might expect, the proportion of returns of questionnaires was related to contest status. The highest proportion of returns was from the Winners, second, from the Honorable Mentions, and third, from Others, those who received no honors. It might also be noted that there has been more communication between Science Service and the Winners than with the other two groups.

Certain information from the Science Talent Search files was added to each of the questionnaires returned: sex, rank in high school class, size of high school class, choice of occupational field given at time of the Search, and residence (city and state). These data were added to give more information about career growth and development as well as to aid in the selection of the interview sample.

Tables IV-2 and IV-3 show for STS-1 and STS-2 respectively the Science Aptitude Examination scores of the participants who returned the questionnaire. The scores are shown as errors; the lower the score, the higher the quality of performance on the test.

Both Tables IV-2 and IV-3 show differences in test scores for males and females. Such differences have appeared for each succeeding Science Talent Search (7). There are no data to show whether these differences are due to difference in the self-selection of the boys and the girls participating in the Searches, or are products of the cultural role images and expectations of boys and of girls.

These tables also show considerable difference in the apparent difficulty for the two tests used. This presents no problem since each examination is used by itself with no reference to any other year.

Since the Science Aptitude Examination is not a standardized test and has no norms except for the group participating, relative standing in the high school graduating class may be helpful in showing the quality the participants demonstrated in high school.

Table IV-4 shows the relative rank in high school graduating class for those who answered the preliminary questionnaire. Almost all were above the middle of their graduating class. There are no data to characterize the entire group of participants, since high school relative standing was used as one of the successive hurdles and not as the initial hurdle.

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*Tables for Section IV are shown as Appendix IV.

Selection of the Sample for Interview

The frequency distributions of the characteristics of the participants reported above were considered in drawing the sample for interview. Those who were to be interviewed were drawn from those who returned the six question preliminary questionnaire, and who indicated in response to the sixth question that they would be willing to fill out a longer questionnaire and participate in an interview. The number to be interviewed was determined by two considerations: sufficient to meet the needs of the study and within the research budget available. It was planned to interview 150 of the participants distributed according to sex and contest status as shown below.

Contest Status	Males	Females	Total
Winners	22	8	30
Honorable Mentions	30	10	40
Others	60	20	80
TOTAL	112	38	150

The selection of the 150 names was not completely random. The Winners selected to be interviewed are 30/80ths of all of the Winners in STS-1 and STS-2. It had been hoped that the sample could be restricted to 4 or 5 areas in the United States, such as the Boston, New York, Washington, and perhaps the Los Angeles areas. This could not be done since the required number of Winners to be interviewed did not live in those four areas. It was necessary to include not only those named, but to add Pittsburgh, Chicago, Milwaukee, Madison, San Francisco, Los Alamos, Boulder, and Philadelphia. The area selection was used to keep interviewing costs within the budget and to be fairly sure of finding a qualified person to do the interviewing. The 30 Winners selected for interview are representative of the 80 Winners of STS-1 and STS-2.

The 40 Honorable Mentions chosen were selected to be a random sample of the Honorable Mentions, but restricted to the locations just named above.

Selection of the 80 "Others" did not follow a random procedure, although the resulting selection appeared to be quite satisfactory. The 80 "Others" selected were chosen as follows: First of all, only the names of Others who lived in the selected areas were drawn. The 80 were then chosen on the basis of groupings which might be used to explore various hypotheses regarding careers and career development of people who as high school seniors had said: "I expect to be a scientist." Attempt was made to find a number of occupational groups such as practicing physicians, medical research, research engineers, production engineers, salesmen, college teachers, high school teachers, elementary school teachers, military service, and government service, so that various hypotheses could be explored. The sub-samples as such were too small to be used for defining or for testing hypotheses, but could serve to open further and perhaps clarify some of the concepts that might be shaped into explorable hypotheses for later definitive study.

As soon as the 150 names had been selected for the interview sample, each was sent a longer six page questionnaire.* This questionnaire was organized to cover present job, outside activities, publications, military service, education and training, work experience, and patterns of influence of people and events on the career. This questionnaire was returned by 140 of the 150 persons, and interviews were obtained with all but 4 of these. One was out of town during the interview period and the other 3 failed to meet with the interviewer. A total of 136 persons, 105 men and 31 women, were interviewed.

Table IV-5 shows the distribution of Science Aptitude Examination scores of the 136 who were actually interviewed. The Honors Groups, both male and female, show aptitude test scores similar to all those who won honors. The Others groups may be considered a fair sample of the Others who replied to the first questionnaire.

The Interview

One or two interviewers were selected for each area. Each interviewer had had extensive training and experience in interviewing. In all, 30 interviewers participated in the study.** They were instructed not only to obtain answers to the questions listed, but also to explore carefully any other topics or hypotheses they thought might be useful in understanding the pattern of career development of the interviewee.

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* This questionnaire is shown in Appendix II.

** The names of those who served as interviewers and the materials sent them are shown in Appendix III.

The interview was designed to take no more than one to two hours, and at time and place convenient to the interviewee. Most of the interviews were conducted during evenings or on week ends.

The materials supplied to the interviewers consisted of three items:

1. A page of instructions reviewing briefly the background of the study, purposes, how the interview should be conducted plus the general procedures for handling the paper work and reports.

2. A list of 15 topics to be covered in the interview was included. This did not constitute a questionnaire, but was a list of areas of information to which the interviewer was to seek answers, more or less in his own fashion, without any necessary sequence or order to the questions as long as answers were obtained to all of them. The sequence, however, was the investigator's estimate of an easy and comfortable sequence of topics from the point of view of the interviewee.

3. A copy of "Factors in the Early Motivation of Scientists," by Dr. Anne Roe, published in the Proceedings of the Seventh Thomas Alva Edison Foundation Institute. This material was pertinent to answering Question 15 in the Interview Topics, "Was the early history of this person consistent or not consistent with Anne Roe's hypothesis regarding early factors in the development of scientists? Explain?

In addition to these general items, the interviewer had an opportunity to study the long questionnaire returned by each of his interviewees. This questionnaire had been reviewed by the investigator and then forwarded to the interviewer.

After the interviewer had received the long questionnaire from the investigator, he made contact with the participant by telephone or by letter, and set a time and place for the interview. All of the interviewers report that the interviews were pleasant and comfortable, and that the cooperation of the participants was unusually fine, both in terms of their willingness to participate and in their wholehearted discussion and presentation of their career development history. The degree of insight obtained from this exploratory study would have been reduced considerably were it not for the excellent cooperation of the participants and the high quality of the interviewing.

The interview reports were presented in narrative form, organized as answers or reports pertaining to each of the topics listed. Since the study was primarily exploratory this flexible form was preferred rather than a more structured report.

The long questionnaire and interview topics were tried out with 6 STS Winners from later years. Not only did these people fill out the questionnaire and participate in an interview, their reactions to the procedure were sought and used in the revision of the questionnaire and the interview questions. The author of this study is grateful to these Science Talent Search Winners for their cooperation and help.

Before the interviewing was actually started, the investigator tried to visit all the interviewers and succeeded in seeing 20 of them. The visit was to discuss with the interviewer the background of the STS, how the STS had been conducted, both administratively and technically, the purposes of this follow-up study, what kinds of commitments* might be made to those who have participated, and to offer opportunity to clarify any questions about this study and about the interviewer's role in this study.

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* Each person who participated by filling out the long questionnaire and being interviewed will receive a summary report of the research.

V

FINDINGS FROM THE LARGER SAMPLE

A look at the 1550 who returned the short questionnaire showed much information which could serve as a basis for speculation regarding the early identification of science talent, and its later growth and development. Among the facts which came to light are the following:

1. There is a positive relationship between the scores made in the Science Aptitude Test and the highest academic degrees attained within the ensuing fifteen years. In general, the higher the degree, the better the average test score. (See Tables V-1 and V-2, Appendix V.)

   Those having no college degree showed the poorest average test scores, with those holding the Ph.D and DSc having the highest aptitude scores. Again, one must remember that these are not random samples of the degrees reflected.

2. From the point of view of the selection of those who carry honors, it may be noted that 45% of the Male Honors group (includes both Winners and Honorable Mentions) reporting that a doctoral degree while 28% of the Male Other group with the same range of test scores had doctoral degrees. Among the women reporting, 22% of the Honors group had doctorates, while only 8% of the Others group had such a degree. The evidences shown by Tables V-1 and V-2 suggest that not only does the Science Aptitude Test have validity as a selector, but the other selection factors, high school record, teachers' anecdotal recommendations and the project report are additionally effective as selectors of contestants to be awarded honors.

3. A positive relationship between the mean science aptitude scores and the present occupational field is shown in Table V-3. The physicists generally have the best scores and the chemists are close by. That there is substantial agreement between the evidences shown for STS-1 and STS-2 is represented by a rank correlation (rho = .76) between the rankings of the mean Science Aptitude Test scores for the fields of science for the two groups.

The differences between mean test scores for various fields of science cannot be charged to errors of sampling, as attested by the F ratios given in the table. Both of these statistics show that the odds are considerably less than one in a hundred ($p < .01$) that the observed variations in means could have occurred by chance.

These differences reflect at least two kinds of selection: The "natural" selection associated with the fields themselves, and possibly the selection associated with responding to the questionnaires.

Due to small numbers of cases the test scores for women were compared only in terms of "homemakers" and "others." The difference in mean test scores for these two groups for STS-1 was not significant. For STS-2, the mean test score (errors) for the homemaker group was 20.7, and for the non-homemaker group, 26.6. The difference is statistically significant beyond the 1% level.

4. The same relationships were evident when, as high school seniors, these same participants indicated the occupational fields they then expected to enter, but it was less clearly drawn.

   Table V-4 summarizes the relationship of field of choice as a high school senior and mean score on the Science Aptitude Examination. The differences in the mean score among the groups for men were found to be greater than could be accounted for by chance. Differences among the mean scores for initially chosen fields for women did not show statistically significant differences.

5. Table V-5 shows the highest academic degree received by the participants according to their early choice of field. Doctor degrees are obtained much more often by those who won honors in the Search. This should be expected if the selection for potential as a creative scientist has any validity. Stopping at the bachelor's degree is more usual for women than for men. There is much variation from group to group in the per cents who obtain a doctor's degree. This ranges from none for the "Other Sciences" group to 58% of those who originally wanted to go into medicine. In general, it might be reasonable to assume that those with the ambition to want to enter a field in which a doctoral degree is either a necessity or quite desirable must have more ability and also have greater drive toward academic successes.

6. Those who went on into science, on the average, came from larger high schools than those who did not go into science. Size of high school did not, however, show a relationship to choice of field made as a high school senior. Table V-6 shows the average size of high school graduating class according to the present field of the male participants. An F ratio of 3.085 makes it necessary to assume that the differences in mean class size shown in the table did not arise by chance. The most distinctive differences are between those in science fields and those in non-science fields. The latter come, on the average, from high schools with smaller graduating classes. Is it possible that this is the result of better equipped laboratories and/or better prepared teachers in larger schools? There is little difference in the mean class size for the men and the women (161 and 144 respectively).

7. One of the most interesting tables in the entire study is Table V-7. This table shows that there is substantial correspondence between choice of field as a high school senior and field of interest some 15 years later. The selection of the 13 fields of interest into which the data are tabulated was made to show trends without hiding them in a welter of detail.

The relationships between the original choice of field made as a high school senior to present field of activity may not be representative of all high school seniors nor of high school seniors who intended to be scientists. They represent only a backward look for those who replied to the questionnaire. It does show the consistency of early career choice (as of twelfth grade) and later realization, covering a span from 1942 and 1943 to 1957 for a total of 1, 234 men and 316 women.

Those participants who started for one field and wound up in another are of considerable interest. No information as to reasons for these changes was available, though a little turned up from the interview group. The need for further study along this line is discussed under VIII: Next Steps.

Each horizontal row of information in Table V-7 shows the present field for those individuals who had a common field of interest as high school seniors. Each column of the table shows the field of interest as high school seniors for those individuals presently in the same field.

To read the table, one might start with the first row of the table. Of the 47 boys, both Honors and Others, who as high school seniors wanted to go into biological sciences, the largest number, 10, went into "non-science fields, professional or managerial." Almost as many went into medicine and other medical fields. Only 8 of the 47 are presently in biological science. For the girls, 23 wanted, as high school seniors, to go into biological science. Thirteen of them were homemakers fifteen years later. Only two stayed in the biological science field.

The picture in engineering, as shown on the next row, is a little different. Of the 541 boys who as high school seniors said they were going into engineering, 241 actually arrived there, and 40 more went into the physical sciences. It is interesting to note that this group contributed substantially to the MD's; 24 who started out to be engineers ended up as MD's. However, a considerable number of those who headed for engineering went into non-science fields.

The medical sciences have been divided into two groups: Those whose aim or achievement was the MD degree and practice of medicine, and those in other medical sciences. One hundred twenty-three of the males in the sample aimed for medicine, and 67 got there. This is the highest percentage of achievement of early aims of any of the groups included. It has been said by college counselors that "the desire to get into medicine is more nearly a religion rather than a vocational aim." It may be noted that of the 36 girls who as high school seniors said they were headed for medicine, only 4 arrived.

Of the 164 boys aiming for chemistry, 33 actually arrive in that field. To these, however, should be added 27 who went into engineering. Of 60 girls who aimed at chemistry, 5 are now in chemistry and 1 in engineering.

Of the 1550 who returned the questionnaires, 264, about 17%, had expressed no choice of field at the time they were high school seniors.

Looking at the columns in Table V-7, one can get some answers to "where did they come from?" The biologists appear to be largely people who intended originally to go into science, with no marked predominance of any one area of science unless it is chemistry. Engineers are persons who originally aimed for engineering or physical science, especially chemistry. This sample of MD's come largely from those who had aimed for medicine or engineering. The physical science group have origins similar to the engineers. This is also true of those who are in non-science fields.

Of the 316 women included in this table, 160 (51%) are homemakers. If we add to these those who gave no answer to the question regarding present field, this per cent becomes 60. This percentage is fairly uniform for the various fields aimed for as high school seniors. Sixty-one of the women went into non-science occupational fields, plus 160 who are homemakers, and 30 more gave no data as to field. This leaves 80% of the women now outside of science and only 20% remaining in science. It is interesting to note that one-half of the women who stayed in science, stayed in the field they started for in high school. In case they gave an occupation plus homemaking, they are recorded under that occupational field. These women are also carrying homemaking duties as well. The question of combining a career in science with a career as mother and homemaker is discussed further on the basis of the interviews with women.

It must be remembered, when trying to generalize from these data, that the sample is made up of relatively bright persons who as high school seniors indicated a strong desire to make some field of science their career. More information is needed here. What non-science career aims seem most likely to produce scientists? And the most important question of all, "What factors were most influential in effecting the career changes?"

8. Table V-8 shows the present field according to kind of work. Of the 1550 participants, only 7 were identified as research directors, 67 were research personnel, carrying on individual research, and 50 were research associates or research assistants, a total of 8% of those answering the questionnaires.

The great majority of the sample are persons engaged in practicing or producing in their field. This includes most of the engineers and MD's, in addition to the non-science group. This grouping includes both those who are self-employed and those who are employed by an organization. Most of the MD's are self-employed, while most of the engineers are employed in non-research engineering jobs. It is quite possible that some of the physicists included in this category really have research responsibilities. For example, a respondent who reported that he is a physicist and works for the RST Corporation is included in this category. He is put with a research classification only if his job is known to be a research job.

Teaching includes all levels of teaching - college, high school and elementary school. Of those who are teaching, 63% of the men and 33% of the women are apparently teaching in some area of science, though this was not always clearly stated.

It is interesting to note the small per cent of this group who are engaged in sales. Two hypotheses are offered to account for this fact:

1. Boys and girls who, as high school seniors, show any preference for a career in science do not include sales as part of that role concept; and, hence, even in leaving science do not leave it for a sales career.

2. Those among the original STS participants who have entered sales as a career assume that since they are not in a field of science that the Search and Science Service can have no further interest in them and hence do not bother to reply to questionnaires.

Table V-9 shows the kind of employer relative to present field.

Business and Industry rank first as the employer of the STS participants, employing just over half of all the men.

Self-employment ranks second. A large proportion of this group is composed of physicians in private practice. Seventeen per cent of the Male Others and only 9% of the Male Honors are self-employed.

Colleges and Universities are the third employer group. Here we find 20% of the Male Honors group but only 10% of the Male Others. Of the 67 employed by the Military as officers, 20 are working as scientists.

Government employs a number from all the fields, but not an outstandingly large proportion overall. High school teaching has drawn a number, but only 12 out of 42 high school teachers were clearly identified as teaching science.

9. Table V-10 shows the highest academic degrees of the respondents classified according to present field of activity. In this sample the biological and physical sciences have the largest proportion of doctor's degrees of any of the fields, excepting medicine. Only 7% of the engineers have doctorates. In all fields, the proportion of doctorates among the women is lower than that among the men. This may represent conflict of interests between profession and homemaking, or it may represent a lower level of aspiration, or it may possibly reflect the assumption that the opportunities for women in these fields are more limited and do not represent a sufficiently greater opportunity with a doctorate than without it to make it worth the effort to earn the degree. It may also be noted that the proportion of women in the various fields who have a master's degree is distinctly lower than that of men.

   Only 12% of the men and 27% of the women in the sample reported no academic degree. This latter per cent has two major components; those who are homemakers, and those who are classified as "Non-Science, Other."

   There are at least 4 persons in the medical field who have both a Ph.D and MD degree. There is one with an MD and the DDS degree. Doctorates in the "Other Medical Doctorates" include the DDS and the DVM degrees.

10. Military Service: All but 13% of the men report some military service between the time of high school graduation and the time of the questionnaire. A few have made military service their career.

   Those who were selected for interview were asked to comment on the benefits and hindrances to their career by military service. Most of them reported nothing worse than a delay in their career plans. Others reported position benefits particularly deriving from added maturity and a chance to set better plans. A considerable number reported that the GI bill had helped considerably, and two or three indicated that had it not been for that bill it is likely that they would not have gone to college.

Table V-11 shows the frequency distribution of males according to number of months in service spent by them. It must be remembered that these men graduated from high school in the war years of 1942 and 1943.

Table V-12 shows the per cents of the men, by present field, who served as officers in their military service. Most of those in medicine served as officers after their medical training. Those who attained the higher ranks, e.g., Major or higher, had chosen a military career and had spent the longest time in military service.

11. Table V-13 shows that 85% of the men and 78% of the women reported that they were married. For men this is only slightly lower than the population as a whole. The U.S. Bureau of Census figures for 1957 show 87.1% of the nation's males in the 30-34 year group (which these are) have married.

For females in the same age group, however, the census figure is 92.7%. This leaves the women in the studied group lagging considerably more than their male colleagues. That this is not by design on the part of science-dedicated women to avoid family and home responsibilities, but seems rather to be the unwelcome result of moving up competitively in a male dominated area, is discussed in Section VI, Findings from Interviews with Women.

National figures for the frequency of divorce in this age range were not available, but it is possible to compare this group with some others which have been studied. Terman* reported in his study of gifted men who were college graduates, 8% divorced. At the time of this calculation his group had a mean age of 30. Roe** reports for her eminent biologists a divorce rate of 15%, but her subjects were in the 28 to 58 age range, so that more of those who ultimately would have divorced had done so.

For the STS group, the reported divorce rate was considerably lower than in either of the two above groups, being 1.1% for men and 1.3% for women.

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* Terman, L.M., Genetic Studies of Genius, Vol. IV, Stanford Univ. Press, 1925-47.

** Roe, Anne, A Psychological Study of Eminent Biologists, Psychological Monographs, Vol. 65, No. 14, 1951.

Table V-14 shows the numbers of married participants in the Science Talent Search according to numbers of children reported. Fourteen years after high school graduation those who are married reported an average of a little over 2 children per family. The average number of children is slightly higher for the Honors than for the Others. This difference is greater for the men than for the women. The women who won honors and later had children had on the average more children than did the men who won honors and later had children. This could be related to difference in age at marriage.

VI

FINDINGS FROM INTERVIEWS WITH MEN

This section is a report on the information drawn from interviews with 105 male participants of the first two Annual Science Talent Searches. About one-fourth were "Winners," another fourth were "Honorable Mentions," and about half were "Others" who had won no honors.

The purpose of this section of the report is not to compare those who stayed in pure science with those who moved away, nor is the purpose specifically to see how different the later lives of those who won honors might be from those who did not. Rather the appropriately broader objective for so exploratory a study is to say, so to speak, that here we've found out what some of the early participants in the STS have done with their lives; the number of cases is few, yet the variety of data is great. Whatever kinds of hypotheses might be suggested by them are worthy of further study.

Certainly the long-range goal is clear, and that is better understanding of the nature and nurture of scientific talent. At this stage we are interested in everything and anything available. There is, however, one kind of restriction to our interest, and that concerns the fact that the data are organized and categorized in a certain way. That is, the cases are grouped together along certain lines, but not by scientific discipline as such. The number and specificity of disciplines is too great for a study of the present scope. Instead the cases are organized in terms of the general role played in society. The 105 men who were interviewed were classified as shown in Table VI-1.

To give a clearer picture the five largest of these groups have been singled out for comparison and comment. In the comments which follow it must be remembered that the numbers of cases are very small and that the comparisons and conclusions offered may border on speculation. Such speculations, however, are the seeds of hypotheses for later study and testing.

1. Medical practice (N=11) - a very clear and common role indeed, in fact a profession. The emphasis is on application rather than search for new knowledge.

2. Medical research (N=11) - the pure science hand-maiden to the profession of medicine.

3. . College professors (N=14) - representing a variety of science specialists who have chosen the academic role.

4. Industrial research (N=12) - people of various disciplines who have chosen industry as the setting for their role in life, and

5. Industrial management (N=13) - people who have become primarily involved with their skills for leadership and organization, and may have given their interest in science or research a secondary role.

These present five different environments. They include the practice and profession of medicine, the pure science laboratory, the academic life, the industrial laboratory, and the environment of management and leadership.

The remaining ones, taken together, closely resemble the picture presented by the fifth group, the Industrial Managers, but have not been combined with that group.

These five environments represent very different ways of life. Yet the STS participants of 1942 and 1943 have found their way into them all. We may ask them how different are these ways of life, what are their individual appeals, how do youngsters make their choices, how might they better make such choices, etc.

In attempting to find answers to these important questions the five groups will be compared on such factors as the following, all based on analysis of interview content:

a. Influences on career choice and development

b. Marriage and degrees

c. Military experience

d. Job likes and dislikes

e. Work and play

f. Societies and community activities

g. Publications, patents and honors

h. Friendship patterns

i. Career changes

j. Their children as scientists

k. Advice to future STS participants

Influences on Career Choice and Development

The influence of professors and teachers, the major influence in all other groups, is almost completely absent among physicians.

For all of the practicing physicians group family influence ranks first in determining this area as a career choice. Fathers, brothers, or cousins were doctors, or the family physician was a childhood hero. There are only two mentions of high school teachers, and one of these was cast in the role of father substitute. Possibly the practice of medicine is so tangible a social role that it can be seriously evaluated by children long before formal schooling and vocational choice become issues in their lives.

Two of this group while in high school, wanted to be engineers. Chemistry, bio-chemistry and zoology were other interest fields mentioned before medicine dominated. One reports trying to do a piece of original research in zoology in college. Out of this experience came the realization that research was hard work, and that he really wanted to work with people.

Among the 27 researchers, including those in medicine, industry and government alike, but not including research directors, parental influence was more than adulation or following in father's footsteps as in the medical practice group. And it began early. Events recorded as influential include grandfather drawing diagrams of the Christmas tree wiring for the curious five-year-old, Sunday walks along the railroad with father who pointed out interesting things about construction along the way, sons who were invited to sit in the group and listen when father's friends dropped in for informal discussions in chemistry, or opportunity for adult conversation with professor father's graduate students. Parents of this group are generally reported to have encouraged children to explore and to seek for answers to their own questions. They provided chemistry sets, telescopes, Bunsen burners and books, but they also gave the child freedom and responsibility at an early age. Two report that their foreign-born parents could not help them with school work, but held high standards for the child's achieving on his own. One says his father taught him respect for doing things, another learned accuracy, another admired his father for resisting the lure of a greater salary in industry in order to remain in his college physics laboratory as a teacher.

For research people, it appears, the influence of parents was strong. The status of science, scientific method or research within the family can be a strong influence, offering protection against the forces toward intellectual conformity and mediocrity.

To those concerned with the effect of awards and scholarships on the interest of youngsters in science, this may suggest a firmer policy of drawing parents and family into the rituals of praise and recognition usually focused on the young recipient of the award alone.

As a group these researchers were notably not "people oriented." There were 9 for whom there was isolation in pre-school and grammar school days, either as an only child (6), a rural child (1), or separation from the usual play groups for physical reasons such as asthma (2). For them books, chemistry sets and home laboratories became a refuge. One reports that he early learned escape from "people problems," fights with other boys, etc., by coming home to his hobbies. Another never knew any other children until after he was seven. Stein and Shannon* found that creative research chemists tended to report greater isolation from parents in early adolescence.

Attitudes identifiable with research were apparent early, as in the unusual curiosity of one which led him to teach himself reading, mathematics and chemistry at an early age, just because he wanted to know; and as in the skepticism of another who at 6 doubted that it was really a fairy who put the penny under his pillow in exchange for his lost tooth. To test the hypothesis he tied the tooth to his ear, which signalled him in wakefulness in time to catch his culprit parent when the exchange was attempted.

At school it was the teachers' attitude more than the subject itself which made the deep impression. An even half of these researchers mention high school teachers in subjects ranging from chemistry, mathematics and physics, to English and political science. They remember them because they "aroused intellect," taught a "probing approach," taught "enjoyment of science," "encouraged creativity" or gave them after hours access to the laboratories.

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*Shannon J., Early Detachment and Independence in a Study of Creativity, (unpublished manuscript) Univ. of Chicago, 1957.

Among the 14 college professors, all teaching in some area of science, their own teachers ranked first in frequency of mention (10) as influences in career choice and development. Of the 10 influential people, 7 were mathematics teachers, 2 physics, and 1 was a chemistry teacher. Perhaps the fact that this small sample of college professors includes 4 who are currently teaching mathematics themselves contributes to this apparently heavy weighting in mathematics influence. The family was influential here too, but interestingly, it is not the parent, but the older brother or friends of older brother who turns up most frequently as the childhood hero.

Of the 13 in the industrial management group, 5 reported that they had been most influenced by their work associates, the men they have met in business, their supervisors and bosses. When high school heroes are mentioned it is because they were boys of strong character and decisive action. Two mention high school teachers who were demanding and held high standards. One credits a college professor who taught him the "hard facts approach," and another makes special mention of his wife with her "keen and logical" mind. Only 2 mention parental influence of a positive nature - the expectation of perfection in achievement and pride in a job well done and in perseverance. It is interesting to note, however, that a greater proportion in this group than in any other (4 out of 13) were separated from a parent by death or other circumstance before high school age. While the data cannot be regarded as complete since such a question was not specifically included in the interview, there may be meaning in the observation that the only other groups which did report loss of a parent were the medical practitioners (1) and the medical researchers (3). In this group also there is more frequent mention of early dissatisfaction with the family economic status and a consequent desire to better the parental record on that score. For these men the highly competitive, more financially rewarding environment of industry has had great appeal.

In all these groupings there are some who report in such fashion as, "I intended to be a scientist since I was 8 years old," "received a chemistry set as a child and the fascination still lingers," "knew at 16 what I wanted to be," "decided on medical career after two years in high school." But there are also those who needed more time to find their niche. These include instances such as these:

1. After 2 unhappy years with poor grades in medical school was so inspired by his summer job laboratory director that he returned to medical school to stand first in his class.

2. Found mathematics difficult in high school, avoided physics, felt only moderate interest in science until age 30 when chance got him into research, his "curiosity started firing" and for the first time he felt a serious interest in anything and realized that he had to work harder. He is now in medical research.

3. Ran away from home and joined the Marines after failing to achieve STS recognition. Got high test score in General Classification Tests and was sent to university for engineering training.

4. Discovered he had an aptitude for teaching when granted a fellowship involving part-time teaching duty.

5. Two, now college teachers, report histories of "flunking" as undergraduates, but returning after the war to different majors and continuing to doctoral degrees.

Those interviewed also included 16 who have "strayed" into non-science areas of work, although as high school seniors they showed interest and ability in scientific subjects, in fact 6 of the 16 achieved honors. The cases are too few and too diverse to draw conclusions, but it is of interest to note some of the general factors recorded as influential in diverting them from science. Listed in the order of frequency with which they were mentioned, these include:

Desire for money (6)

Drifted (5): Some regret lack of guidance in school, some drifted into family business or whatever job was at hand.

Desire to work with people (4): These are the lawyers and salesmen.

Pushed into STS by teachers (3): Science interest was not a real and personal one.

Interest changed in military service (2).

Recruited into other areas (2): Persuaded into better job opportunity that chanced along.

Family ridiculed science or influenced to other fields (2).

Couldn't afford college (1).

(Note: The total for the above is more than 16 because some credited more than one factor.)

Marriage and Degrees

The median age at marriage, at attainment of highest degree, and average number of children for the men interviewed in this study are shown below:

Occupation Group	Mdn. Age at Marriage	Mdn. Age at Highest Degree	Average No. Children
Physicians	24.0	24.0	2.7
Research - Medical	25.0	26.0	2.5
Industry	25.5	26.6	1.8
Government	25.3	26.5	1.7
Research Directors	23.2	27.5	1.8
Industrial Management	23.1	25.4	2.5
College Professors	24.2	26.2	2.0

As a comparison the U.S. Bureau of Census figures for 1950 show the median age at first marriage for the nation as a whole was 23.9 years for males. None of the medians shown differs much from the national norm.

The physicians group show larger families than any of the groups studied. They are most likely to have obtained their highest degree at an early age. In part this may reflect wartime acceleration of medical training. However, it also suggests that although some physicians decide to marry before, and others after graduation, perhaps both groups anticipate the kind of economic security which will permit large families.

The college professors, however, are most likely to marry early in their academic career, i.e., before attaining their highest degree. That this freedom is economically based is suggested by the fact that the wives of college professors are more likely than other wives to have graduate degrees and to be employed. This does not, however, seem to stop them from having fairly large families.

In looking back over the data from which the above table was derived, it is interesting to note that the accelerated physicians, i.e., without bachelor's degrees, were, with one exception, STS Honors people. Among the early marrying industrial management group, STS Honors people showed up only in the early marriage cases and not at all in the few later marriages. Finally, among the college professors with career wives, the STS Honors group were the exception. They were the ones with non-career wives. These last two observations in particular suggest that the personal awareness of talent may add to feelings of economic security, and that the freedom to marry early or to marry non-career women both are expressions of this security. One wonders how many high school seniors are aware of the economic security value of intellectual talent.

It may be assumed by many students, and by school administrators too, that the students interested in science are not monetarily motivated. Yet there is a vigorous competition among universities for teaching assistants and young research associates, where a difference of less than $500 in annual stipends may win or lose a promising candidate. This is not to say that young scientists are terribly interested in money, but only that scholarly dedication need not be assumed to rule out a reasonable concern for creature comforts. Such an assumption probably does exist in many places, perhaps among those who envy the dedication and begrudge the dedicated any additional kinds of luxuries.

Military Experience

Most of the men studied experienced some delay in their careers due to military obligations. However, a variety of benefits were reported from this experience, and these seemed to differ somewhat from group to group.

Physicians and researchers in industry were more likely than others to have continued their college training while in the military service. Medical researchers, on the other hand, were most likely to have taken advantage of the G.I. Bill, with college professors a close second. These, incidentally, included no STS Winners, who presumably had other financial resources, such as scholarships, or had received professional training as part of their military service.

The industrial management group, however, seemed to have been most affected by military service. They were more likely to indicate a gain in maturity as a result of that experience, as well as a change in occupational goals. Again, no STS Winners were among those so affected.

Winners, in general, were likely to acknowledge the benefit of obtaining experience with people, but this apparently had no particular bearing on career goals. This may have been because Winners were more dedicated, more talented, and/or more confident of an adequate economic return for their talent. It is possible that winning crystallized their vocational goals. The STS Winners, however, also gained maturity but were presumably in science because of something else, i.e., their talent. Their gain in maturity had, for them, no perceptible impact on vocational goals.

This kind of interpretation may shed some light on the difference between adolescent images of scientists and the results of psychological studies of scientists.* The public, in effect, thinks them "queer" whereas research shows them as very fine and mature.

In the light of the above interpretation we might infer that the negative image of science may stem from the less rather than the more talented, that it is based on those who go in for science as an escape and withdrawal. All the more reason then for administrators to screen out the unsettled youngsters looking for a place to hide, and not be pushed into overlooking those motivations by the apparent crisis in scientific manpower.

Job Likes and Dislikes

The subject of overall happiness and satisfaction in one's field of work has been studied from a variety of perspectives. In these cases the data were examined in terms of dedication, job freedom, career development, personal satisfaction, work pressure, financial security, job or working conditions, status, and/or work management. Here the groups differ from one another quite noticeably.

Most physicians consider themselves "satisfied" or "content" but not "dedicated." This is just opposite from the medical researchers where most are "dedicated." Perhaps this is in fact a function of the context of the study. The cases are former STS participants and in this respect they recognize the study as a further study of "scientific" talent. To the extent that, as practitioners, physicians feel that they have deserted pure science for professional security, they may be overly apologetic about their career satisfactions. On the other hand, the industrial management group shows no such tendency.

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*Mead, M. and Metraux, R., "Image of the Scientist Among High School Students," Science (Aug. 30, 1957).

No group, other than the medical researchers, shows a majority who appear dedicated. The college professor and research in industry groups do show significant minorities who appear to be dedicated. The industrial management group shows a smaller percentage.

Medical researchers expressed more satisfaction with their job freedom and its importance to them than did any other group, especially with regard to setting their own tasks. They also like making their own decisions, but this is also found in the industrial management, college professor, and research in government groups.

Medical researchers also appreciate the creativity allowed in their work, but it is the researchers in industry who make the most comments on job satisfactions of this kind - perhaps not because of greater job freedom (i. e., to set own tasks) as such, but because of more adequate facilities and financial support.

Under the heading of career development we begin to encounter particular complaints that explain some of the job character factors present. For example, while researchers in industry have good things to say about growth and vacations, almost half complain about the necessity for taking on supervisory or managerial responsibilities.

On the subject of career development the industrial management group has only good things to say, specifically about advancement, growth, leave and professional contacts.

So far as personal satisfaction is concerned, it is clear that the college professor group stands out in its appreciation of the "way of life" provided by their work.

Industrial managers mention creativity in their work, with researchers in industry also inclined to so comment. Comments on intellectual challenge are also prevalent in the industrial management group but even more frequent among the medical researchers.

Practicing physicians meanwhile, and especially the Winners, complain openly about the lack of creativity in their work, the routine and the monotony.

In turning to comment about "pressure on the job" it is only the industrial groups who respond in these terms. Some of the industrial management groups like the pressures involved in financial planning. Others dislike the pressure from the sales department or associated with the sales viewpoint. Researchers in industry meanwhile complain about the time pressure they are under, and also about their lack of interest in the products involved.

As for financial security, it is the physicians and to some extent the researchers in industry who stand out with favorable attitudes, whereas the medical researchers and the college professors reflect unfavorable attitudes.

When it comes to job conditions, the various groups comment about quite different things. The physicians like their associates, but dislike the long, exhausting hours. Medical researchers like their associates. The industrial management group likes the variety, the people, the problem solving but dislikes the paper work. College professors like their associates, teaching, and the environment but dislike the paper work. Researchers in industry like their associates, and the combination of pure and applied research but dislike desk and paper work.

As for status, physicians feel successful and also feel that they have social recognition. Medical researchers feel only the personal success. The industrial management group feels mainly the personal success but some social recognition. Meanwhile the college professors and researchers in industry actually complain about the lack of social recognition.

In this recital several things stand out. One is the bored and fatigued case of the physicians, however well paid and esteemed by society. Theirs seems to be more of a craft or trade than an intellectual role, and one in which many work with their hands as well as their heads.

Another is the relatively impoverished and classically dedicated role of the medical researcher, free to combine a search for knowledge with the most altruistic of goals. Despite such sacrifices as late marriages they show a greater feeling of overall happiness than any other group. Put another way, ideological or personal esteem seems to surpass money and recognition as a source of satisfaction here.

Also striking is the "way of life" orientation of the college professors. It seems to set them apart more from society than any other group. In this connection one might speculate that researchers, whether in medicine or in industry are likely to be no more or less humble than the next man. The "teacher," however, is "always a teacher" and is occupationally disposed to think of himself as superior in knowledge. In this land of rugged and sometimes "uncouth" democratic values, the teacher cannot therefore be a well-loved person.

Finally, and as almost a counter balance to this, there is the emphasis on creativity among the industrial management group. This is a concept heavily stressed these days in management, i.e., "creative leadership," etc. Without any implication that management is not creative, one may still ask if the trend towards speaking of the "science" or "profession" of management (and all the creativity thereby required) does not in part represent a desire on the part of business men to acquire some of the status of science and the drama of the creative intellectual act. The trend is a healthy one, no doubt, but it is interesting to note how, as the prestige of science advances, industry and science draw closer together. They are creative. They earn good money. Meanwhile only the medical researchers are left with pure dedication, and the college professors go on being thought of as snobs with great concerns for certain exclusive features in their way of life. The implications of all this is that the cultural residues of brain vs. brawn conflict in America are disappearing in the face of the rising prestige of science.

Another speculation is that as scientific talent comes to be seen as just another special area of aptitude, it will not be interpreted to mean that the talented one is "better." That is, with so many aptitudes and skills required and valued in our complex society both in work and play, the science talent may be socially balanced by others. This question fortunately can be put in terms of how much status will be accorded to the science talent of youngsters, or resentment felt toward those youngsters by other youngsters with other degrees and kinds of talent. In short, can youngsters with talent gain the respect of their peers in an atmosphere wherein society, or at least school society, stresses social talent above all else, or where talent and individual differentiation in general is the rule? How round about must we go? How many compromises with sensitive feelings of relative self worth must we make in order to procure an elite group which can go ahead and give free vent to its scientific skills?

Work and Play

Most of the physicians studied work more than 60 hours a week, medical researchers about 60, college professors about 55 and all others 50 or less. Most groups take work home with them, the industrial management and researchers in industry groups excepted.

Spare time activities cover a great range and variety among physicians and medical researchers, but medical researchers are particularly great readers. They read more non-professional than professional literature.

Medical researchers and college professors both go in for the active sports. They hike, ski, swim, or bicycle, activities which can be either group or individual.

Movies and TV are only mentioned to a degree by the medical researchers. Physicians seem to turn more to spare time in order to renew their scientific identities through professional reading and group meetings, and medical researchers use this time more to relax from a more than adequately scientific identity on the job role.

Medical researchers are also frequent travelers, while the industrial management group spends much time on home maintenance and improvement. College professors are fairly high on both of these. Our researchers in industry seem to be the hi-fi addicts.

Societies and Community Activities

About three is the average number of scientific and technical societies to which our groups belong. Physicians are a little above the average here, but quite below average as far as community activities are concerned. Medical researchers are just the opposite. They are low on number of societies, except for the STS Winners among them, and highest of all on community activities. However, no specific activity stands out.

The differences in professional society membership may be attributed either to the greater need for re-enforced scientific identity, or to the greater professionalization of their roles - with all that this implies for the plethora of county, state and national medical associations. As for community activities, the physician can hardly need to advance (or risk) his already high status in the community in non-medical roles. Therefore, one would not expect much activity of this sort even if time were available. For medical researchers, on the other hand, it has been noted that while high on personal esteem they lacked a sense of social recognition. For them, therefore, any excursions into community activity can hold the promise of a possible gain in status.

The industrial management group showed the widest spread among its members in the number of professional and technical societies to which they belonged. This varied from 0 to 5 or more. Though fairly active in community groups such as school recreation and civic service it was religious groups which were most often listed.

College professors are second highest in number of societies, although within their group it is the STS Honorable Mentions who have more memberships than the STS Winners. The college professor group is lowest of all on community activities, and this is indicative again of their marked "way of life" preference with its undertones of withdrawal from the outside world.

Researchers in industry are highest of all on number of societies. They record highest in community activities, and although these activities covered as wide a range as any, there is, as in the industrial management group, a tendency toward participation in religious activities. This may represent either conformity to a generally conservative atmosphere in industry - or to some selective factor in the attraction of certain scientists to industry.

Publications, Patents, Honors, etc.

Half of the physicians have had no technical publications. Only one had more than three. This contrasts sharply with the medical research group, where half have had six or more publications. However, half of the latter group are Ph.Ds rather than MDs and it is generally among the Ph.Ds where one finds the strongest tradition and pressure to publish. Neither group has had any patents, both have had some academic honors, and the medical researchers stand out somewhat in having gotten along without so much benefit of scholarships while in college.

The industrial management group also stands out as scholarship-less, while the college professors are highest in number of publications - apparently again a symptom of the Ph.D culture.

Researchers in industry meanwhile stand out as having the widest range of publication behavior, some do and some don't. They are highest on number of patents taken out. Finally, despite their lack of scholarships (like the industrial management group) they are highest in academic honors.

Friendship Patterns

Among the factors common to personal friendships, work is easily the outstanding. However, it is low among physicians - presumably because they work alone - and at its high among college professors with their large families.

Music seems to be a special factor among physicians, hobbies and sports among industrial managers, and social factors among medical and industrial researchers.

Career Changes

When asked what they would do differently if given the opportunity to re-do their careers, a host of ideas came forth. However, it was striking that in each group there were more who would, than would not, make some change in their careers. This was especially true among the researchers, both in medicine and in industry, and least true among physicians and college professors.

The specific changes were many, but rarely involved a change in vocation as such. Thus college professors talked about getting a broader educational base or getting through with their education faster, etc. (most groups had comments too various for generalization), but only a handful openly discussed a switch to something else. Thus we can take the previously mentioned differences in number of changes between researchers and "professionals" to mean simply that the research role is less clear in our society and that the occupants of those roles would "tinker" more with their development to get their roles accepted in the right way.

Their Children as Scientists

When asked about their child becoming a scientist many said "yes," and many said they would leave it up to the child. Few said "no." This leaves it rather vague as to what extent the question gets at attitudes toward science and to what extent it is a measure of parental permissiveness. However, it is the industrial manager, and researcher in industry - who are more likely to say "yes" - and the college professors, in this case perhaps better described as educators valuing freedom of the mind, who are most likely to leave it up to the child.

Advice to Future STS Participants

A number of very general themes developed out of the interview question on what advice would be given to future STS participants. Most common were such themes as "be broad" - perhaps more common among physicians and industrial managers; "take physicis and math early" - more common among college professors, and researchers in industry; and "don't go in unless you're sure, and don't make your choice of specialization too soon" - more common among college professors. Most of these advices seem to say that one should build his scientific specialization on a broad base.

SUMMARY

Having compared the five groups of cases on each of ten or eleven factors in their development, it would be appropriate to draw together such differences as have been noted. Taken together, rather than factor by factor, the differences may provide insights not otherwise obtainable. Again it must be remembered that these samples are very small and drawn from a group of persons who participated in the Science Talent Search as high school seniors. They do not represent random samples of the occupational group.

Our small sample of Physicians are a group of hard working (they report more work hours per week than any other group), somewhat bored professionals who despite uncontested status and recognition feel little scientific dedication to their work. They came into their field without significant influence from teachers. Family influence largely took the form of hero worship of a doctor father, or adult close to the family. They have achieved economic security, have been able to raise large families, but use their spare time, more than any others, in professional reading and group meetings. Time with their families, music, theater and golf or tennis rank high in their recreational activities.

The Medical Researchers included here are also a hard working group of people, but dedicated, enthusiastic, and relishing a creative and free environment in which to set their valued scientific tasks. This is a group with high personal esteem, though lacking in social recognition. Despite the latter, and the lower salaries, late marriages and smaller families that this entails, this is a group seemingly content to have paid an economic price for happiness. And happiness does seem an appropriate term to use, since job dedication does not exist here at the added cost of spare time pleasures and relaxations. On the contrary, this is a group that does relax and enjoy its spare time. This is not a group so "dedicated" that it keeps its nose to the grindstone all the time. In short, scientific dedication, while leading to heavy hours, does not demand the whole of an individual's life. Rather, one real enthusiasm breeds other enthusiasms. Psychologically speaking, this is a far healthier picture than that of the physicians and pleasantly contrary to some of the popular stereotypes of the scientific "grind" or "drudge."

The 14 College Professors are a group set apart from society in its concern for a way of life that leaves little room for activities in the outside community. Its values are held all the more tightly by a preponderance of "academic" marriages with career wives at least partially employed along similar lines. It is a group that derives its friendships from on-the-job activities largely within the academic community. It is the group that values its kind of freedom of the mind to the point where it alone would leave the choice of a child's career primarly up to the child. It is, on the whole, a group oriented more to intellectual values, which is quite a different thing from the particular search for knowledge motivating, e.g., the medical researchers. It is our college professors, apparently more than those engaged directly in research, who persist in questions about the general direction of inquiry, the use and role of science in society. Put another way, we might ask if the exclusive way of life of the academician is not the necessary atmosphere in which to question and speculate over just these larger issues. Certainly the church has always had its monastic retreats for scholastic meditation.

Why should the scholar not need some kind of separation from the crowd, in order that he too may be offered the kind of detached perspective conducive to simplification of basic issues? Perhaps this then is the true source of public uneasiness with the college professors for they are tinkering not with value-free facts and figures, as does the researcher, but with matters of right and wrong, good and bad - even as applied to science.

The 12 Researchers in Industry as a group know responsibility and a fair amount of work experience early. It is a group that married late, and began good earnings late. However, its members did not marry academic or career wives, and have retained enough of a religious orientation to be rather immune to the academic concern with questions of values and/or an intellectual way of life. These then are working scientists, for hire, and by and large not troubled by the larger issues, and not concerned with needs to separate themselves from society for any particular purposes. It is a group that finds challenge and stimulation in its work but is irked by attempts to be shifted away from this work in the direction of supervisory responsibility. It is a group whose spare time activities are also most technical, e.g., hi-fi. This, however, suggests a narrowness in outlook not shared, for example, by the medical researchers with their wider variety of non-science relaxations. In short, the researchers in industry have the intellectual challenge but not the enthusiastic dedication of the medical researchers. The former are serious conservatives. The latter find more than pleasure and contentment in their work; they find joy and spiritual reward. Put another way, the researchers in industry find skill and spiritual satisfactions in two different areas, work and religion. The medical researchers appear more nearly to find both satisfactions in their work.

The 13 Industrial Managers report the shortest work weeks, least home work and most community activities which are religious group connected. These combine more of their friendships with hobby and sport or "play" activities, marrying earlier and pressing confidently toward success and advancement. Early influences in their career choices came more from work, bosses, supervisors and job associates than from family or teachers. They find opportunities for creativity in work. It is a group that sounds like the normal, healthy personality engaged in the conventional American competition for success. What jars this picture, however, is that this stereotype is supposed to involve "hard work," yet our two industrial groups work least hard of the five. It appears then that industry, too, may have more of a "way of life" attraction complete with the financial and masculine (e.g., "mature," "sports," etc.) accessories of the more prestigeful and dominant industrial values of our times. This group, of course, must be judged a happy group, since it has "no problems" to speak of.

Taking an overall view of the portraits just presented, one is struck by the very different atmospheres and qualities prevalent. One may wonder, considering the few cases and the amount of speculation involved, just how widespread or representative are these qualities really? And if they are widespread, is this matched by appropriate awareness of them by youngsters at various ages, and various stages of vocational choice? Such questions require more data on which to base answers.

Differences between the groups seem as large as the differences between non-scientific vocations, yet the "visibility" of the qualities of the five groups varies too - with medicine (i.e., the "doctor") certainly highest. One would guess then that the differences involved are only dimly appreciated by youngsters and that their readiness to choose or even consider some of the roles involved is very shaky indeed. Certainly the spelling out in detail of the gaps and confusions will permit guidance counselors and other officials to take remedial action on at least an informational basis.

One might infer that youngsters are kept too engrossed with differences between physics, chemistry and biology, as such, to appreciate the other aspect of their vocational choice. This other choice, furthermore, the choice role, will probably have more to do with their long range of happiness on the job - because it involves differential pressures, rewards and satisfactions which, so far as the disciplines themselves are concerned, are relatively constant. That is, we would predict a greater difference in satisfaction for individual X when comparing his life as a chemist in a university with his life as a chemist in industry than the difference obtained by comparing his life as a chemist in a university with his life as biologist in a university.

Another striking observation is the minor role of status and prestige, a factor of supposedly vital importance in our middle class society. Physicians have status and are not content, the medical researchers are very happy without it, the college professors are doggedly concerned with values which make their status necessarily ambivalent, etc. One cannot help but feel that all of these people have developed occupational identities that far outweigh their class and caste concerns, and that only among the less skilled would there be so much need to evaluate one's self worth primarily in the eyes of others. This perhaps is what gives scientists their reputed independence of thought, i.e., they know how good they are and need not fear the judgments of others. One implication here is that youngsters with the scientific talent have little need of prizes and ceremonies as such (those should be fore the parents). What they need is the tests against which to measure and confirm themselves, the acknowledgment of respected and knowledgeable teachers, and the tangible and realistic compensation of the scholarships, grants, etc.

Finally, it should be noted that the range of satisfactions prevalent in the four science groups (excluding industrial managers for the moment) is great enough to provide a way of life to suit almost any kind of normal personality. Thus for a child with scientific talent there should be no cause to reject any and all kinds of careers in science on such grounds as hard or easy, rich or poor, socially significant or insignificant, etc. The range and variety is great enough for any talent, if only they were aware.

This argues strongly for the supplementation of information on how the sciences differ from one another, with information on how scientists and scientific roles differ from one another. To youngsters, science can be presented as a wide variety of potential jobs and careers, with something to suit almost everyone.

VII

FINDINGS FROM INTERVIEWS WITH WOMEN

Thirty-one women, a sample of those who participated in the Annual Science Talent Searches of 1942 and 1943 were interviewed for this study. Of these, 14 had won honors and the remaining 17 can be presumed to have had more than average interest in science at the high school level to have entered into the Search at all. Now, 15 years later, only 3 of the 31 do not hold college degrees, but even these three followed their science interest into some form of science after high school training.

Of the 28 who finished college, more than half (16) hold degrees beyond the bachelors and almost one-fourth (6) have achieved the doctorate. The degree group includes one each in astronomy, psychology, zoology, biochemistry, and chemical engineering. There are two physicists and two MD's. However, there are six chemists, plus one in chemical engineering. Is this heavy grouping in the chemical area typical for women? If so, why? Is more training in this field available to women as students? Does it offer better employment possibilities without presumed sex discrimination? Does it appeal to women's ability to do careful, meticulous work?

What sparked the original interest in science, at what age and how did it occur? What kept these young women on the science track in spite of general public acceptance (stronger 15 years ago than now) of science as a man's field? What has led a third of them to continue in some form of scientific practice in addition to assuming roles as wives and mothers?

The earliest interest reported was that in geology and astronomy at the second grade and subscription to a science magazine at fourth grade. This supports the importance of "exposing" children to science materials at earlier ages than has been rather generally thought appropriate. Personal "discovery" of science was otherwise reported at sixth grade, high school and college levels. Two said they could not remember when they had not been interested. Curiosity about science seemed to have been part of their make-up always. An older brother's chemistry set, being allowed to "tinker" in the home workshop with her father, an uncle's interest in chemistry, and a desire to be like the father who was a chemist turn up as early interest sparking devices.

This seems to support the observations by others that cultural environment, the kinds of toys and the kinds of play activities approved help set the stage for later vocational choice. Emulation of the father, or father figure (uncle, older brother, admired male teacher) are also noted here.

Teachers' influence began early. Among those teachers reported as influential, almost as many were in the elementary grades as in high school and as early as the fourth grade. Such influence was not limited to science teachers. One Latin teacher arranged an engineering interview for a student which helped her in her later career decision, another reported an elementary teacher and English teacher as being most influential in helping her realize her own potential.

Family climate encouraged these girls to "look up" answers to questions themselves, to collect facts rather than opinions, to invent their own quiz games, to enjoy and excel at chess, word and number games, to make good grades and to get a better education than the parents may have had. There is no evidence of parents influencing any of these girls away from science, rather there are commonly such comments as, "My parents never pressured nor advised me," "Mother supported me in all my decisions," "My parents expected me to complete any task I began. Without that training I probably wouldn't have finished graduate school when I had the babies." Parents generally held learning in high regard although less than one-third of the fathers and only one-sixth of the mothers had college degrees.

*Family structure has been examined and conclusions from numerous studies seem to point up the scientist as typically an only or oldest son. This was not disproven for this small group of women, but neither is the evidence strongly in support. Six were "onlies" and ten were oldest, but seven were the youngest, four were in the middle and for two we have no data. **Roe has reported that biologists studied tended to have lost a parent at an early age. In this group three had lost a parent before the age of 18.

Economic need was mentioned twice as a strong motivating factor. These two young women saw in science, specifically in the medical area, assurance of later income and freedom from the economic insecurity in which they grew up.

STS recognition seemed to serve in two ways in that it brought additional funds through scholarships which made continued education possible and,

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*Super, Donald and Bachrach, P.E., Scientific Careers, Vocational Development Theory, Teachers College, Columbia Univ., 1957.
** Roe, Anne, A Psychological Study of Eminent Biologists, Psychological Monographs, Vol. 65, No. 14, 1951.

perhaps even more importantly, it brought confirmation of their own worth and ability. Of the 14 honor winners in the group, only one failed to complete college and only two did not go beyond the bachelors degree. Six achieved the doctorate. The non-honors group of 18 included 2 with no degrees, 10 who went no further than the bachelors and only one who attained the doctorate. This could indicate that STS, even in these early years, did function as a selector of real talent and ability. It may also mean that the self-confidence engendered by STS recognition, plus the scholarship assistance contributed to the impetus needed to go on to graduate work.

What forces motivate the married women to continue some form of scientific endeavor concurrently with home and family responsibilities are not specifically expressed, but some answers are implied. Interestingly, those with the higher degrees are most frequently the ones who have continued to work after marriage. These led to a number of questions as to why this should be so. Attainment of the higher degrees may be evidence of their greater interests. The higher degrees may have qualified them for some form of research, critical or analytic writing, etc., which can be carried on more readily at home or under less rigid requirements as to hours and regular schedules than technical laboratory work at lower professional levels. It may be that the higher the degree the greater is the motivation to contribute or "pay back" society. If attainment of higher degrees is one mark of greater ability to organize time and use it productively, such women by nature and training must be better equipped to handle two assignments.

One potent factor in continuing to work is the approval and encouragement of the husband. For the most part these women have married men from their own science field. Only one is an exception to this for those women who held degrees beyond the AB. At the bachelors degree level it is still true in part, but less markedly so. It is only in this latter group that we find such comments as, "My husband doesn't want me to work. Says his wife doesn't have to." Contrarily, in the higher degree group we find repeated references to the spouse as the most important influence in the woman's career, appreciation of the husband's respect, support and encouragement in their work, and the anticipation of more joint projects as the family grows up.

In the beginning of the study it was the intent to classify the women in the same manner as the men, according to broad vocational or career groupings. This was abandoned partly in light of the small number of women, but more importantly, it was because of the realization as the evidence was studied, that the most unifying factor in the whole group was a persistent expression in one way or another, that the satisfactions of science notwithstanding, marriage was of first importance to fulfillment as a woman. Categories then became simply the Marrieds (20) and the Singles (11). From this point on these two groups will be compared.

It could be hypothesized that complete dedication to science has led the Singles to choose to by-pass the complications of marriage and homemaking. However, study reveals little evidence of such dedications to science or, indeed, of job satisfactions sufficient to compensate for a more real desire for marriage. These women appear to find rather that the more competent they become, the higher up the ladder they struggle in academic degrees, economic independence and professional recognition, the more completely they are isolated from male social companionship and prospects of marriage. There are observations that the job bars meeting eligible males, that social activities are limited to women friends who are as alone as they, that they would welcome more opportunity to share in married faculty activities, that the woman who becomes an "expert" is suspect in male circles socially. There are fears of loneliness if marriage is not realized, fears of losing, or appearing to lose, femininity if they advance into the more masculine realm of executive administration, even a fear that science generally makes women masculine.

Unfortunately, similar problems are likely to face the unmarried career women in any line of endeavor. However, it may be they are more acute here because the public image of the scientist continues to be so strongly masculine.

This is not to say that none of the Singles is happy in her career. There are many expressions of contentment and anticipation of future developments in their work, but the yearning for marriage either in addition to or in place of the job is evident. There is only one brief mention of inadequate salary scale for women with the implication that it was better for the other sex.

The question as to whether a woman trained in science must choose between career and home is clearly answered in the fact that as many as one-third of the Marrieds are continuing some professional job activity plus their home duties. It has already been noted that those with the higher degrees are the most likely to do this, but it is also important to observe that, in sixty per cent of these, marriage, and in some cases children, preceded the higher degrees by time spans up to as much as five years. This figure would be still higher if we included those who married the same year they were granted their highest degree (beyond the bachelors).

In continuing their education, as well as in working after marriage, these women give credit to the encouragement and cooperation of their husbands. In no case did any of them see the combination of endeavors as presenting any big problem. One does admit that, if doing it over, she might have delayed the babies until after the Ph.D, and another relates a period after marriage in which she precipitated a serious illness by being unwilling to compromise between furnishing and decorating a home, cooking elaborate meals (all on a limited budget) and at the same time trying to complete her doctorate.

The age at marriage in this group (MS, Ph.D and MD) varies from 22 to 29, age at birth of first child from 24 to 32, and age at highest degree from 23 to 27. In these respects there is practically no difference between this group and those who did not pursue their education into graduate work. The latter married at ages 20 to 31 and had first children at 22 to 32. There is, moreover, little difference in the present number of children. Those who went on to do graduate work (and who are more actively continuing their careers) now have from 0 to 4 children, an average of 2.1. Those who hold only the bachelors degree and who are predominantely devoting all their time to home duties have 0 to 5 children, averaging 2. 2 each. It would appear then that, for this particular sample at least, continuing a science education and a career is no deterrent to establishing and maintaining a home and a family - given a husband who is sympathetic, approving, and who works in the same or a related field.

Playing the dual role of scientist-homemaker, however, is not entirely one of undiluted bliss, as the preceding paragraphs may imply. The difficulties most often reported seem to be in the area of identification with, and acceptance by, peers in the local feminine community. There are reports, for instance, that fellow housewives incline to the "egghead" view of the scientist-mother, looking upon her as "different," possibly even inflating her status to a point which makes her feel awkward and set apart in the homemaker group. To avoid this, one prefers not to let her neighbors know of her connection with the downtown university so that in her neighborhood she may remain just "one of the girls." For others, this kind of feminine identification has been simplified by the birth of a first child. Babies, then provide a common area for conversation in groups of their own sex where they had previously felt alien.

Whether to stay at home with the baby or return to the accustomed lab duties and leave the infant's routine care in other experienced hands at home is a difficult decision to make. Some choose to do the latter, feeling, or rationalizing, that the child does not need the mother now as it will when it is past infancy and well on toward school age. This decision in turn may lead to feelings of guilt, particularly in the light of what they think others may think.

There is acknowledgement that pregnancies have limited outside work from time to time, that the husband's job is of first importance and if a move is indicated for his advancement then severance of the wife's work connections follows as a matter of course, but on the whole there is a general buoyant attitude that balance in the dual role is possible and that maintenance of the career interest assures the family of a happier, more interesting person in the mother role.

What are the kinds of work these women are able to do while rearing families? The cases are too few for any large groupings, but they include such diverse areas as those of astronomy, physics, teaching and the practice of medicine. Some are on a full-time basis of 40 to 50 hours per week, and some on part time of 8 to 20 hours per week. Some require leaving the home in order to work in the laboratory or classroom, but many entail reading and preparation which can be done at home. Working on research papers, editing and abstracting, free lance writing are included.

Most of these anticipate increasing the number of work hours per week as the family grows up. Many indicate a desire to teach, some to return more actively to research laboratories. Among those not now working, a few rule out any intent of ever returning to the lab or classroom but many express a desire for further study and/or a hope to return to the old job or advance to new ones when the children are older. Some recognize that by that time they will have lost touch with their specialty and question whether they will have the desire or initiative to bring themselves sufficiently up to date to be employable.

In general the hobbies of the two groups would seem to differ very little from those we would expect to find among any group of women with similar educational background. In order of preference we found the married group most frequently participating in arts and crafts, such as ceramics, sculpture, sewing, embroidery and knitting, then reading, followed by outdoor activities, including camping, hiking, gardening, swimming, golfing and riding. Equally popular were music and participation in groups related to the school or church and local study groups.

Only two out of the group seem to find pleasure in decorating and fixing up the house. Theater, bridge, TV, photography, antique collecting, cooking or travel, were listed by only one each.

Among the single women, the arts and crafts were again most popular. Music was second, reading third, and photography ranked fourth. Dancing, travel and group participation were enjoyed by three. Satisfying hobbies were found in writing and cooking by two women. Chess and exploring were each mentioned by one.

In the area of community activities, as one might expect for the married group, we find that education and school activities are first in frequency, civic groups were second, religious groups third, recreational and cultural groups next, government and political groups were less popular with only two participating.

Four of the married women professed to have no community activities whatever.

There seems to be very little difference between the two groups related to publications. Ten of the married women, in spite of their many other activities, have publications, some of them only 1, but 2 of them as many as 9 each. Of the 10 married women who have never published, 9 hold a bachelors degree. Among the single women, about the same percentage, almost half, have publications, again varying in number from 1 to 10 or more. One of this group holds a patent. Six of this group have no publications whatever.

In answer to the question, "What would you do differently if you could do your career over again," the married and single women were pretty much in agreement. As a general summary the things they would do differently included the following:

5 would choose a more adequate high school or college than the one which they attended.

5 would have broadened their chosen major field.

4 would have chosen a different major entirely.

4 would have taken more liberal arts.

2 would have sought more social and extra-curricular activities.

2 would organize their time better and study more effectively.

1 would have sought vocational counsel in planning her career.

1 would have delayed her babies until later in her graduate study.

6 were completely satisfied as is and probably would not change a thing if they could go back over their careers.

VIII

NEXT STEPS

Observations reported here suggest a number of questions which need further and more intensive investigation. Many of these could be explored effectively through data obtainable from larger samples of those who have participated in the annual Science Talent Searches over the years.

These questions and possible studies are listed below without any attempt to rank them in importance. Through all of the suggested next steps there runs the need for "control" groups to which the experimental group may properly be compared. Some of them were suggested by those who read this report critically in the first draft. To these critics the author extends his thanks.

1. There is need to make a follow-up study of the careers of a known group, using a better defined sample than employed in the present study, so that conclusions and generalizations would be more valid. This might be those who graduated from high school in 1946 and 1947 (STS-6 and STS-7). Then, taking the present study as exploratory, consider the 1946-47 populations as the study group and make both an extensive and intensive study of it; extensive in the sense that one would aim for 90% or more returns and intensive in the sense that the questionnaire would be ambitiously thorough. The same group could then be treated as a continuing panel of respondents for further studies, referring back or interpreting any new information received from them in the light of what had been initially accumulated in the questionnaire study. Throughout the present study the need for more representative sampling was shown.

2. An important need, noted by other investigators as well, is a study of the later careers of persons who as high school seniors expressed a serious intent to enter specific fields of science. How many of these ten or fifteen years later were actually active in those fields? What became of those who left? What influenced them either to stay or stray?

   Attacking the problem at the other end one could also look at those who have arrived in a given field today to find out what brought them to it and what were the earlier factors of influence.

Even more important than a study of people who are operating in specific fields, as chemistry for example, is the need to look at the whole matter of career choice, development and present performance with an eye for common patterns without regard for particular science fields.

3. There needs to be more study of the careers as a continuing process, developing methods of summarizing such dynamic patterns to give better understanding than do our "cross section" method. Such a study would necessarily continue over the life times of the group of individuals, following the factors and patterns of career development and change. One cannot take any one set of symptoms or characteristics apart from the organic pattern of the individual and have it maximally meaningful.

4. There needs to be study of career roles of scientists as shown particularly in our Findings from Interviews with Men. The identification of the roles is relatively simple, but much more information is needed about the process by which one arrives at such a role. What is the course of the developing perception of the various social roles available in the science fields, such as college teaching, governmental research, industrial production, management, practice of scientific profession, etc.? What are the influences and salient pieces of information which mold these perceptions? Are there observable factors which show preference or promise for one rather than another of the career roles?

   One needs to know whether counseling high school and college students regarding these roles in the light of their present values is soundly based, or whether most of the role values are assumed by the individual after he finds himself in the role.

5. A study of women in science. What factors in childhood play activities, hobby interests, etc., oriented them toward science? What actions and attitudes of parents, teachers and others encouraged or discouraged them? What obstacles were encountered in college training, employment and career advancement because they were women? How can science trained women be effectively productive again in their science areas when their children are grown? How can the two careers, science and family, be developed and combined to give a satisfying way of life?

6. Are there any clues as to physical, psychological or personality types, different characteristics of behavior that add up to varying degrees of creativity? Any other elements in background, experience, exposure to influences that may help develop inherent ability? What clues identify possibly undemonstrated innate ability during early and later childhood?

7. How effectively has selection in the annual Science Talent Search operated? What improvement can be made in the selection of those who receive honors?

8. What is the effect of being "tagged" by the Science Talent Search? In general what are the relative impacts on scientific careers of recognition awards on the one hand or financial rewards on the other? What are the consequences for confidence, achievement, drive, ideals, or career choice?

9. What factors are involved in those choices and/or choice points which make for flexibility and breadth on the one hand or narrow specialization on the other?

10. What are the effects of socio-economic status and choice of institution of higher learning on choice of career? Why does one MD enter research while another goes into private practice? Why do certain schools turn out more graduates who go into research? Does the socio-economic status limit opportunity to enter certain schools thus indirectly affecting orientation?

11. Compare a sample of Others from the STS-42 and 43 groups who did not win Honors but who have since achieved recognition and are active in scientific work, with those who were Honors. Consider such questions as:

    a. Not winning in STS - did it increase motivation and interest?

    b. Could a point of change in career choice be isolated by comparing such groups, and what factors were important in a critical change?

IX

SUGGESTIONS FROM INTERVIEWEES

The interviewees who participated in the first two Annual Science Talent Searches had some advice to offer those who are now participating in the Search. This advice is summarized below.

Career Choice and Development

- Don't specialize too early
- Stay flexible
- Investigate a variety of fields and professions before choosing
- Get broad formal education
- Start work with a company with training programs involving all phases of company operation
- Wet feet in research early
- Don't go into science for glamor

College Choice

- Go to school away from home
- Do your undergraduate work in a different school from your graduate so that you get different approaches
- Go to a kind of school where you can progress as far as you are able and where creative activities are stimulated
- Go to a school where quality of instruction is known to be high

Subject Matter

- Get all mathematics possible for any branch of science
- Include History, Philosophy, Humanities to avoid one-sided background

Personal Development

- Seek top people in field and try to learn from working with them
- Be idealistic, not waylaid by money, ease, or friendship in your drive to forefront of knowledge

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Be forward looking, try to see long-range consequences, even in choosing a wife
Pay more attention to people, less to formulae
Learn to make own decisions early and rapidly
Be willing to be different
Get broad liberal arts background
Be receptive to problems outside own specialty

APPENDIX I

Letter and Preliminary Questionnaire Sent to Large Sample

SCIENCE SERVICE

THE INSTITUTION FOR THE POPULARIZATION OF SCIENCE organized 1921 as a non-profit corporation, with trustees nominated by the National Academy of Sciences, the National Research Council, the American Association for the Advancement of Science, the E. W. Scripps Estate and the Journalistic Profession. WATSON DAVIS, DIRECTOR.

1719 N Street, N. W. WASHINGTON 6, D. C.

June 26, 1957

Dear STSer:

Through a small research grant from the National Science Foundation, we have been enabled to take another step forward in our basic science research, the identification and development of creative talent in science.

The plan of this present study calls for interviews with about 150 Participants in the first and second annual Science Talent Searches for the Westinghouse Science Scholarships (1942 and 1943). Later studies will be more inclusive, and will seek answers to questions about career development which this current study cannot encompass. They will also ask about other questions which were raised by the information from our sample of 150.

The study will be under the direction of Dr. Harold A. Edgerton, of Richardson, Bellows, Henry & Co., New York City. Dr. Edgerton has been a judge for the annual Science Talent Search since it began, and with Dr. Steuart H. Britt, has constructed the Science Aptitude Examinations and other selective procedures used in each Search.

As a first step in this study will you answer the questions on the back of this page? Then mail your replies in the yellow envelope right now. Your answers will help in selecting the 150 to be interviewed. We plan to interview about 40 who were Winners, 40 who won Honorable Mention, and 70 other Participants.

Our sample, we hope, will have both scientists and non-scientists in it. Both are necessary to give us the understanding we are seeking in regard to the growth of careers of scientists. We expect, also, to get information so we can do a better job of selection in future annual Science Talent Searches. Geography may have something to do with your selection, since we cannot draw a purely random sample and at the same time afford to interview each such individual no matter where he may live. We will draw our sample from those who live in areas with a high saturation of STS Participants for 1942 and 1943.

Whether you wish to be included among the 150 to be interviewed or not, please send in your reply. The information which it carries will enable us to do a better job of selecting the 150 for this study.

For those who are to be interviewed in the present study, you will be asked to do two things: First, fill out the questionnaire to bring your STS follow-up record up to date. Second, we would like to have a competent interviewer talk with you about your occupational and educational history, how you have viewed it, how you have felt about it, the kinds of events and people which have influenced your career, and so on.

As soon as possible after we hear from you, we will select the 150, and send each the questionnaire and arrange an appointment with an interviewer in his area at a time which will be convenient. Your cooperation in this important study will take some of your time. We trust that it will not be too great an amount of time nor too much effort.

It is our hope that we can continue to conduct these follow-up studies keeping in touch with you and with others in later Searches in order to learn more about the development of careers in science and also about the factors which lead some people, who at one time have thought seriously about being scientists, into occupations other than those included in the sciences.

Your cooperation and help in this important study are greatly appreciated.

Sincerely,

Watson Davis

Watson Davis
Director

WD:fgk
Enclosure

PLEASE FORWARD

1. My address should be corrected as shown in the address above.

2. I am now employed as a ______________________________

My employer is ______________________________

____

3. I am ☐ single, ☐ married, ☐ widowed, ☐ divorced.

4. I have _____ children.

5. My highest academic degree is _________. It was granted by

____

college or university

6. I served in the Armed Forces for ______ months.

My highest rank/grade in the Armed Forces was ______________________

7. If I am selected as one of the 150, I will fill in the questionnaire and participate in the interview. ☐ Yes. ☐ No.

APPENDIX II

Materials Sent to Interview Sample

SCIENCE SERVICE

THE INSTITUTION FOR THE POPULARIZATION OF SCIENCE organized 1921 as a non-profit corporation, with trustees nominated by the National Academy of Sciences, the National Research Council, the American Association for the Advancement of Science, the E. W. Scripps Estate and the Journalistic Profession. WATSON DAVIS, DIRECTOR

1719 N Street, N. W WASHINGTON 6, D. C.

September 25, 1957

Dear STSer:

We have selected the 150 participants from the First and Second Annual Science Talent Searches who are being asked to fill in a longer questionnaire and participate in an interview. You are one of the 150.

The procedure is as follows:

1. We are enclosing the questionnaire with some brief instructions for filling it in. The form has been designed to be as easy as possible for you.
2. Please fill in the questionnaire as completely as you can and mail it back in the enclosed envelope.
3. Following this, a skilled interviewer from your area will get in touch with you to arrange a convenient time and place for an interview. The interview will be concerned more with your attitudes and feelings regarding your career and related events, your plans and aspirations, and any advice or suggestions you might wish to pass along to later participants in the Science Talent Search. Suggestions regarding the Search itself will be appreciated.

Please accept our thanks for participating in this study and in adding to our knowledge and understanding of the factors related to the development of careers in science.

Cordially,

Watson Davis

Watson Davis, Director

WD:ah
Enclosure

A Follow-up Study of Science Talent Search Participants

ANSWERING THE QUESTIONNAIRE

Each Participant in the first and second Annual Science Talent Searches who is included in this interview follow-up study has indicated his willingness to fill out the accompanying questionnaire and to be interviewed regarding his career.

All information given will be used only in summary form and will not be individually identifiable.

The enclosed questionnarie has been designed to make it as easy as possible to fill out. A few directions may make it even easier to you to do this and also for us to organize your answers in a consistent and meaningful fashion.

In general:

1. Please try to answer each question, and where there is no answer, put a dash in the answer space or write "no data."
2. For those questions on which you feel that additional detail or explanation is needed, please put the additional information on the back of the sheet with its question number.
3. Please return your completed questionnaire as soon as possible so that an interview schedule in your area can be set up.
4. For those questions for which you do not have exact or precise answers, make the best estimate you can and record that.

Some of the questions may need more specific directions than are given or implied in the questionnaire. These are 11, 12, and 13. The directions for these are as follows:

> Question 11: Education Since Leaving High School: You will notice a number of columns. (Complete all the information regarding one institution before reporting on another one.)
>
> > The first column (11.0) is Schools Attended. In this column write the name and address of each institution you have attended since leaving high school.
> >
> > In Column 11.1 Please give the dates you attended that school, the date you started and the date you left. If you do not remember the exact dates, give the approximate dates.

In Column 11.2 indicate any degrees which you have been awarded and the date of such award.

In Column 11.3, Program Followed, please indicate the curriculum or program as specifically as you can in terms of the vocational aims which it might imply; for example, chemistry major, electrical engineering, bio-chemistry, and so on.

In Column 11.4 please characterize each school. There are various ways of doing this. We would like to know: was it a small or large school, state-supported, was it a liberal arts college, did it have a highly selected student body in terms of ability or family background and so on?

In Columns 11.5 and 11.6 please give briefly the events and persons that had influence on your career.

> In Column 11.5 indicate the EVENTS which had the greatest influence on you. Please indicate what they were, e.g., scholarship award, a good exhibit, some particular course, and so on, and also tell briefly what its impact was on your career.
>
> In Column 11.6 indicate any PERSONS who were distinctly influential in the development or shaping of your career. Please indicate the relationship of those persons to you, e.g., teacher, friend, father, and so on. Please also tell briefly the impact of this person and how it occurred.

In Column 11.7 indicate any scholarships which you have received. Show the name of the scholarship, its amount and duration (1 year, 4 years, etc.).

In Column 11.8 indicate any honors you have received, such as special awards, prizes, medals, election to honorary societies and the like.

After you have finished the information for one school, draw a line under that school clear across the page and take up the material for the next school.

Question 12: Occupational History, asks for considerable detailed information about your job history. Be sure to include all of your employment since high school on this sheet, including part-time, summer, and incidental employment as well as full-time professional positions. It has been our experience that some of this kind of employment, while apparently at the time was non-professional and unrelated to your goals, nonetheless has contributed towards your career.

In Column 12.0 give the job title, job duties and level of responsibility of the position.

In Column 12.1 give the approximate dates of employment (the beginning and the ending date).

In Column 12.2 indicate whether it was part-time or full-time job.

In Column 12.3 please indicate very briefly how the job was obtained.

In Column 12.4 and 12.5 please indicate the influence of each job on your career.

> In Column 12.4 please report the EVENTS or conditions occurring on the job which had some distinct influence on your career. Please indicate both the EVENT and how it influenced your career.
>
> In Column 12.5 please report the PERSONS around your employment who had particular influence on your career. Please identify the PERSON by giving his relationship to you, such as immediate supervisor, co-worker, and so on, and then tell briefly what impact that PERSON had on your career.

Question 13: Closest Friends and Associates, asks for information about your closest friends and associates. It is not necessary to give the names of the individuals. The form asks that each be identified as to occupation, sex, age relative to you, and relationship to you. In addition, please show the time or stage in your career, e.g., "1946-47" or "during my first year of graduate study," when the friendship was most active, and finally, the common interests or other bases for your friendship.

Please return your questionnaire as soon as possible. A stamped envelope is provided.

A Follow-up Study
of
Science Talent Search Participants

QUESTIONNAIRE

Please answer each of these questions as well as you can. If you feel additional detail or explanation is needed for any question, please put the additional information on the back of the sheet identifying it with its question number.

Please be sure that your name and address are given correctly.

PART A

I. Personal Data

1. My telephone number is ____________. (To make it easier for our interviewer to arrange for your interview.)

2. Marital status: ___ single, ___ married, ___ widowed, ___ divorced.

    2.1 If married, please give date of marriage. ______________ month ___________ year

    2.2 How many children? ___ Dates of birth of children ________________

    ____

    2.3 Occupation of spouse at time of marriage ________________

    2.4 Occupation of spouse now ________________

    2.5 What was the field of study of your spouse? ________________

    2.6 College degrees held by spouse and dates received ________________

3. Military Service: From _____to_____: ___ None

    3.1 How entered ____________ 3.2 Branch of Service ____________

    3.3 Highest Grade/Rank ________________

    3.4 What was your military occupation (MOS)? ________________

    3.5 Decorations or Honors ________________

    ____

    3.6 Present Military Status ________________

    3.7 How did Military Service interfere with your career? ____________

    ____

    3.8 How did Military Service help in developing your career? ____________

    ____

4. Of what scientific, technical, and professional organizations are you NOW a member: (Please list.)

4.1

4.2

4.3

4.4

5. Of what scientific, technical, and professional organizations have you been but at present are not a member?

5.1

5.2

5.3

5.4

6. In what civic or community activities do you NOW participate?

6.1

6.2

6.3

6.4

7. In what civic or community activities have you participated, but in which you are not now active?

7.1

7.2

7.3

7.4

8. Please list two or three persons who have observed the development of large portions of your professional career and who could give their views of factors affecting your career.

8.1 Name
Address
Relationship to you

8.2 Name
Address
Relationship to you

8.3 Name
Address
Relationship to you

9. Please list the honors and awards you have received since graduation from high school. Please list both the award and the date it was received. (Do not list those awards and honors which you listed under 11.7 and 11.8.)

9.1 ____________________

9.2 ____________________

9.3 ____________________

9.4 ____________________

10. Please list your publications: Title, Journal, Volume, Pages, Date. (If under military security, indicate only that there is such a publication.)

10.1 ____________________

10.2 ____________________

10.3 ____________________

10.4 ____________________

10.5 ____________________

10.6 ____________________

10.7 ____________________

10.8 ____________________

10.9 ____________________

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11. Education since leaving high school.

SCHOOLS ATTENDED Since High School Name & Address of School	Dates Attended From - To	Degrees & Dates	Program Followed	Characterization of School	Influence on your career EVENTS	PERSONS	Scholarships Received (duration & amt)	Honors Awarded
11.0	11.1	11.2	11.3	11.4	11.5	11.6	11.7	11.8

12. Occupational History since High School: (Include Part-time, Summer, and incidental employment as well as full-time professional positions.)

Job title, job duties and level of responsibility	Dates of Employment From - To	Part-time or Full-time	How Job Was Obtained	Influence of Job on your Career EVENTS	PERSONS
12.0	12.1	12.2	12.3	12.4	12.5

13. Closest Friends and Associates.

Person	Kind of person, e.g., age relative to yours, sex, occupation, etc.	Approximate Time of Close friendship, or period in your life. From - To	Common Interests (or other basis for friendship)
13.1			
13.2			
13.3			
13.4			
13.5			
13.6			

14. Please describe here any additional factors or evidence pertinent to the development of your career. Describe events, persons, ideas, opportunities, feelings, hobbies, books, etc., not indicated above which had perceptible effect on your career. (This question is of particular importance for those who are not following careers in science.)

APPENDIX III

List of Interviewers
and
Materials Sent to Them

LIST OF INTERVIEWERS

Dr. John R. Barry
Associate Professor of
Psychology and Psychiatry
W. Psychological Institute &
Clinic, University of Pittsburgh
Pittsburgh, Pennsylvania

Dr. Daniel C. Breida
Chief Clinical Psychologist
VA Mental Hygiene Clinic
Rochester, New York

Mr. J. H. Burke
Personnel Manager
General Telephone Company
San Angelo, Texas

Dr. Ralph Canter
Technical Assistant to the
President
Systems Development Corporation
Santa Monica, California

Dr. Robert S. Carter, Professor
Department of Education
Denison University
Granville, Ohio

Dr. Harold A. Edgerton, President
Richardson, Bellows, Henry & Co., Inc.
New York 17, New York

Dr. Frances Estep
Estep Associates
New York, New York

Dr. C. E. Evans
Professor of Management
Wayne University
Detroit, Michigan

Dr. Nicholas Fattu
Professor and Director
Institute for Education Research
Indiana University
Bloomington, Indiana

Dr. Norman Gekoski
Professor of Psychology
Temple University
Philadelphia, Pennsylvania

Dr. Donald L. Grummon
Director and Professor of
Psychology
Counseling Center
Michigan State University
East Lansing, Michigan

Dr. H. Max Houtchens
Chief Clinical Psychologist
Department of Medicine and
Surgery
VA Central Office
Washington, D. C.

Mr. Jerry Kravitz
Director of Personnel
Atomic Energy Commission
Los Alamos, New Mexico

Dr. Gorham Lane
Professor of Psychology
University of Delaware
Newark, Delaware

Dr. Eli Lipman
Associate Professor of
Psychology
Chicago Undergradute Division
University of Illinois
Chicago 11, Illinois

Dr. Russell L. Moberly
The Management Center
Marquette University
Milwaukee 3, Wisconsin

Dr. George A. Muench
Professor of Psychology
San Jose State College
San Jose 14, California

Mr. Richard G. Netzel
Department of Physics
University of Wisconsin
Madison 5, Wisconsin

Dr. Cecil P. Peck
Chief Consulting Psychologist
VA Central Office
Washington, D. C.

Dr. Robert Perloff
Director of Research and Development
Science Research Associates
Chicago, Illinois

Dr. E. H. Porter, Jr.
Assistant Head, Human Factors Department
Systems Development Corporation
Santa Monica, California

Dr. Victor Raimy
Professor of Psychology
University of Colorado
Boulder, Colorado

Mr. Max C. Schnoor, Jr.
32585 Kathryn
Garden City, Michigan

Dr. Clifford Scott
Head, Training Unit
Gulf Oil Corporation
Pittsburgh, Pennsylvania

Dr. Beatrice M. Shriver
(Winner, STS-1)
5107 Allen Terrace
Washington 16, D. C.

Mr. Theodore W. Sill, Jr.
Richardson, Bellows, Henry & Co., Inc.
New York, New York

Dr. William A. Sivers, Jr.
Bureau of Psychological Services
University of State of New York
State Department of Education
Albany 1, New York

Dr. Lester E. Smith
Director of Education, Blue Cross
Topeka, Kansas

Dr. Lawrence H. Stewart
Assistant Professor of Education
University of California
Berkeley 4, California

Mrs. Henry Weinberg, Psychologist
66 Oak Street
Foxboro, Massachusetts

RBH

RICHARDSON, BELLOWS, HENRY & COMPANY, INC.

355 LEXINGTON AVENUE NEW YORK 17, NEW YORK MURRAY HILL 2 6300

December 31,1958

Dr. Ralph Canter
Systems Development Corporation
2500 Colorado
Santa Monica, California

Dear Dr. Canter:

Since you interviewed one or more of the Annual Science Talent Search participants for our follow-up study, we would like your reaction to the first draft of the report on the study. Accordingly we are sending you two copies of this draft. One copy is for you to keep. We would appreciate your marking up the second copy and returning it in the enclosed envelope. A red pencil is provided for your convenience.

In looking over this draft copy, please be a critic, but be specific in your criticisms. You are not expected to rewrite the report. Your criticism could touch on such questions as:

- What hypotheses have been overlooked?
- What misinterpretations of data do you see?
- What errors of fact?
- Should better methods of treatment of data have been used?
- Are there inferences which should have been included and are not?
- What tables are unclear?
- What are the next studies we should seek to undertake?
- Where have we used a big word where a simpler one would be clearer?
- Finally, please be sure your identity as an interviewer is correct.

Again, thank you, not only for your criticisms, but for all of your effort to make this a worthwhile study.

Cordially,

Harold A Edgerton

Harold A. Edgerton
Vice President

HAE:hm
Enclosure

SCIENCE TALENT SEARCH FOLLOW-UP STUDY

Interviewing

A very brief questionnaire was sent to each of the participants in the First and Second Science Talent Searches. These questions were concerned with correctness of address, marital status, job and employer, highest academic degree, military service and willingness to participate in this study. From those who were willing to cooperate, 150 were selected for interviewing.

Each of the 150 was sent a six page questionnaire, asking in considerable detail regarding training, experience, etc. These questionnaires are being returned to me. Each questionnaire is checked for completeness. Additional areas of questioning for each case may be indicated on the questionnaire.

You will have a list of questions to which you are to seek answers in the interview. In addition to these questions, please obtain information about family background: fathers' and mothers' occupations and education; age, sex, education and occupations of siblings; and answers to additional questions I have asked on questionnaire form (usually in red pencil).

Information regarding early career and creativity motivation will be useful.

On Question 2, for non-scientists, explore career motivation carefully--what factors affected career selection and development.

Question 15 requires that you be acquainted with Dr. Roe's hypotheses. A brief summary of her ideas will be furnished to you.

In addition to obtaining answers to all of the questions listed, the interviewer should feel free to explore any other areas which seem to him to have pertinence and interest in the study.

The Report on the interview will contain a summary answer to each of the questions listed. These are not the verbatim reports of the participant who is interviewed but rather the summary by the interviewer himself. The Report of the interviewer need not be lengthy. It should, however, give a clear answer to each question. Each question should be identified by its question number.

I will send to you the long questionnaire for your interviewee. This contains his telephone number and address so you can make an appointment for the interview which is mutually agreeable.

The interview should be easy and friendly--a discussion of the person and his career. It should not be catechistic in style. While you will use probing questions, it is not an unfriendly probing. Taking notes during the interview is quite all right.

Return the questionnaire with your interview report to

Dr. Harold A. Edgerton
4 Nursery Road
New Canaan, Conn.

Addressed envelopes will be furnished. Postage, of course, will be refunded.

Interview with Selected Participants
in the
Annual Science Talent Search

TOPICS TO BE COVERED

1. Just what is his job? Title, duties, responsibilities, creativity, relations to others, etc.

2. How does he feel about his career in science? (If not in science, ask about his career — how selected, satisfactions, status, etc. Get comparisons with his idea of careers in science.)

    a. good points
    b. bad points
    c. which jobs liked best? why?
    d. which jobs liked least? why?
    e. on-the-job supervision
    f. training and career development
    g. status
    h. opportunities for creativity

3. What kind of work or assignment would he like best to do if he had the choice? If interviewee is housewife, what ideas does she have for a career after her children are a little older (e.g., in school, grown up, etc.)?

4. What are his career plans or expectations for the next 2-3 years? (Publications, promotions, changes, etc.)

5. What kind of a position or status does he see realistically for his immediate future? (10-15 years from now) Bases for this estimate?

6. If he could re-do his career, what would he do differently? Why?

7. How does he see the role of science and scientists in our society? (Importance, influence, kinds of responsibilities, etc.)

8. What have been the effects of close pals and "heroes" on his career? (Be specific. Start from list given on questionnaire.)

9. How does he see the effects of age/maturity/experience on his career? (Tie to specific events when possible.)

10. What does he do with his "off-the-job" time? (Leisure, vacations, professional, hobbies, etc.)

11. About how many hours per week does he work? At his job, work taken home to do, other professional activities (specify), etc.

12. What evidences does he use to judge the creativity of a scientist?

13. What advice to future STS participants?

14. Would you like your child to become a scientist? Why?

15. Was the early history of this person consistent or not consistent with Anne Roe's hypotheses regarding early factors in the development of scientists? Explain

IV. Dr. Anne Roe

Chief of the Psychology Training Unit,
F. D. Roosevelt Veterans Administration Hospital,
Montrose, N. Y.

I will ask you to take a big jump, and to bear with me if I give you in very condensed form a very complicated lot of material.

Since my recent studies of scientists, I have expanded my interest in occupation and personality and have done a fairly complete study of everything I could find out about relationships between occupation and personality over the whole gamut of occupations in our culture. There being some forty thousand occupational titles listed in the *Dictionary of Occupational Titles*, this is something of a big order, but, fortunately, psychologists and others have not gotten around to examining each of the forty thousand.

As a result of this particular study, I became more and more interested in two factors that had only begun to emerge in my own studies of scientists and painters. One, the effect of the general social milieu in which the person grew up; and the other, the very enormous importance of interests and attitudes superimposed upon the particular level of intelligence or aptitudes.

We really know very little about what causes these differences. We assume that there are some genetic differences involved in intelligence and special aptitudes, and I am inclined to think this is the case, although how specific these differences are no one knows. But I think that the differences in interests and attitudes are related, rather, to early experiences, and perhaps this accounts for the fact that we do not get correlations between aptitudes and attitudes and interests.

It seems to me when we are discussing factors in the early motivation of scientists that we might get back to real first principles and find out some of the things that seem to be real key issues. I think the one basic key is that one goes into an occupation in which one expects to find satisfactions. You do not know that you are going to be satisfied by a life of science unless you have had some experience of satisfaction in relevant activities.

I am talking about the satisfaction of basic intellectual and emotional needs.

Scientists are individuals, whatever you may be told, and they have all the basic needs of other individuals. Maybe they have some needs in rather higher degrees, such as needs for satisfaction with regard to knowledge. We do not know about this. We do not know anything about differences in basic drive strength; but in any case we do know that we must have satisfactions, or we do not continue.

I have been working for some time now on the development of a theory regarding the areas in which one turns for interests and attitudes. I will not be able to give you any of the hypotheses with which I have bolstered this theory. What I will try to give you today is a diagrammatic picture of what I think happens, without going into why I think it happens; then I will point out what I think its implications are for the problems we have ahead of us.

I should say that this is not just plucked out of a hat. It is a distillation of a great deal of research from a great many different fields. There is very little research that bears directly upon the sort of theoretical structure I am going to give you today. I have compiled information from child studies, such as the Fels Institute and the California studies; from studies on differences between first and second children in behavior patterns; from psychoanalytical studies; and occupational studies of what types of persons go into different occupations. This pattern, shown in the diagram (see p. 12), does seem to me to have some basis of fact.

My concern is how people develop particular attitudes and interests out of their early experiences. I am going back to the earliest years of childhood, when I think these things are laid down, because it is in these very earliest years that we develop a patterning of psychic energies that determines to what we are going to attend involuntarily; it is the things that catch your attention, that you notice out of a total environment, that are the crucial things in developing your interests and attitudes.

In the diagram we have a series of concentric circles. The inner circle is just a representation, very crude, of differences in emotional climate. I use circles because I think we are dealing with a series of continua that come back upon themselves, and what I mean by "general emotional climate" is the warmth or coldness of the family climate.

In the diagram, *C* indicates the coldest point and as you go around the circle it gets increasingly warm. At the dividing line it is more warm than cold, the warmth increasing until you reach *W*, and then decreasing back to *C*. Please think of this as a continuum.

Now, parents have different attitudes toward their children and different ways of behaving toward them, and they may differ from one child to another child, but I think one can pick particular nodal points to point up these differences. I suggest that we may consider three that are illustrated in the next outer circle. One pattern of family behavior may be called emotional concentration on the child, and this I have placed in the top sector, straddling both warm and cold dimensions. In this sort of family, the child's welfare is the central point. The parents are extremely involved emotionally with the child. The child is never freed from close emotional ties of one sort or another.

Another general pattern may be called acceptance, shown on the left of the diagram, on the warm side. The child is just another member of the family, not the most vital one, not the one that is of most concern, but taken as a member among other members.

The last general pattern is avoidance, where the child is not really accepted into the family, not really a center of concern. This is shown in the diagram on the cold side.

There will be differences, obviously, in the way in which these children experience satisfactions, and in the number of satisfactions they experience, but before we go into that, we can subdivide each of these major patterns and see a little more clearly what goes on. These subdivisions are shown in the next circle.

Parents who are deeply concentrated emotionally on the child may react in different ways. One way is the typical overprotective behavior, maternal or paternal, about which we have heard so much. This is on the warm side of the pattern, the overprotective behavior where all the child's needs are satisfied, and not only satisfied, but satisfied with a great to-do. I think we must distinguish sharply between need satisfaction that is just routine—you satisfy the needs as they come up—and need satisfaction that goes with, "Oh, mother wants you to have the very best of everything"—you know, a big hurrah about it.

But we also may have overdemandingness on the part of the parent, and this shades over on the cold side, actually. In examples of this sort, again we may have need satisfaction. We do have for most needs, but the needs to be satisfied are likely to be particularly chosen, and this is a very common pattern, especially in our upper-class groups where there is a sort of *noblesse oblige*. "You are a member of this family, and therefore you must do very well in school, but you mustn't do very well in mechanical things." It often happens, you see, that the demandingness is a limited demandingness, and the areas that are opened to a child are carefully laid down.

Now, this overdemandingness, which is basically rather cold, shades very easily into actual rejection of the child. It may be the obverse of rejection. If you cannot quite reject your child because of general family pressures and general social pressures, nevertheless you can reject him in a sense by demanding of him more than a child can do, or demanding things he is not suited to.

Rejection, however, can go off into neglect, and actually, psychologically, neglect is probably much less damaging than rejection. As long as his physiological needs are taken care of, and if there are no other children in the family who are not neglected, if he is just part of a general pattern of neglect, this is likely to be much less damaging than a pattern of rejection, where the child is actually denigrated.

Now, continuing around the circle, we go from neglect to acceptance. First is what I call casual acceptance of the child. He is accepted as a member of the family; there is a certain degree of warmth; his needs are pretty well satisfied. He probably does pretty much what he pleases, because no one pays any particular attention, and he may develop a very large degree of independence on this basis.

The final category here is what I call loving acceptance, which, as you can see in the diagram, shades into the overprotective intensity with which we started.

I give you these patterns because I think they lead to development of attitudes that are significant for occupational life, or for adult life generally. You will find a good deal of need satisfaction in the loving acceptance group, but it would be in the quiet, underplayed way, differing from this overprotective sort of thing, and it will be restrained in the sense that it is not accompanied with "Mother does so much for you because she loves you so much, and you must do this for her."

What happens, then, in the final adult who is related to these things? Look at the next outer circle in the diagram, which is divided into two sectors. I have been a little arbitrary about these divisions, and in a sense I am guessing as to what happens; but there is evidence, and what I have done is, essentially, to look for a pattern.

This group in the upper sector comes out to be persons whose major orientation and major focus of interest is persons. Now, those persons may be self, and there are a lot of narcissistic attitudes with these overprotective individuals; or they may be other persons.

If your background was on the overdemanding side, and your basic interest is in persons, you pay most attention to persons because they are the ones you have been up against most. This may be a defensive attitude generally. You are on the defensive against those who have expected more of you than you can do, and who have been pressuring you, so you must watch them.

On the other side we can have a nondefensive interest in other persons. You received rich satisfactions from your relationships with other persons, so you want to continue relating to others in a major way.

The rest, those shown in the lower sector, are most likely to come out with major orientations not toward persons. I do not say "major orientation toward objects," because this confuses us with psychoanalytic terminology, when "object" generally turns out to mean another person anyhow. The major focus might be living things or inanimate things, so I just call it major orientation not to persons.

Note that for those from the rejected group, we are again in the defensive area. If you have suffered at the hands of others, if you have been rejected, then you orient yourself away from people rather than toward something else. Orientation away from people is a defensive orientation, whereas, on the other side, where there has been acceptance, where your personal relations have gone so smoothly that they have not required you to pay particular attention to them, you have paid attention to other things in your environment, and there is no defensiveness about it. It is entirely a nondefensive thing.

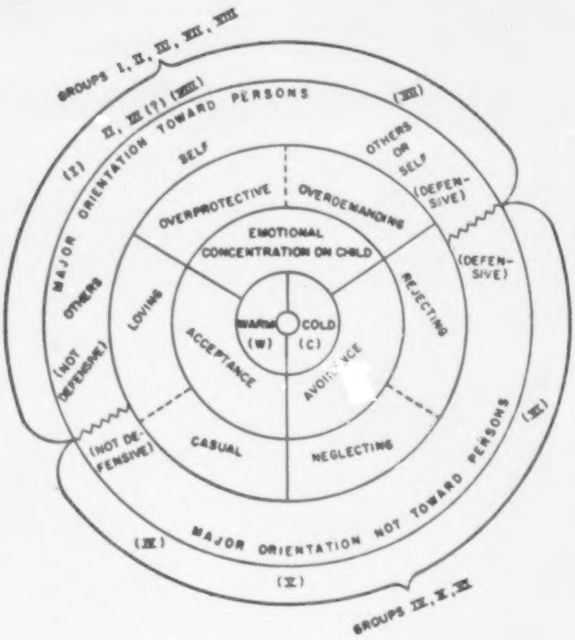
Now, what happens as far as occupations and things of this sort go? I have to refer here to the occupational classification I have devised. If you think of it as an interest classification, it is a little simpler, but my guess is that persons in these occupations are those whose occupational life (it may be the avocational life, but it is usually the occupational life) is concerned with some sort of relatedness to other persons. The diagram shows which groups of occupations attract persons from which backgrounds. There are eight major groups.

Group I are the occupations in which close personal contacts are most important. At the upper levels of this group are the therapists, social workers, and welfare workers of one sort or another. Within each major group you must run your occupational gamut from the Chief Justice of the Supreme Court down to the lowest janitor, and get them all in. At the lower levels are those who are concerned with immediate personal service, and so on.

Group II occupations are also occupations in which the person-to-person relationship is very important, but instead of being a nurturant relationship, as it is in Group I, it is an exploitative one. I do not know that I like to have that term taken down. Life insurance salesmen, bond salesmen, brokers—talk somebody into doing something.

The third group of occupations (Group III) I call organization. This includes the vast numbers of persons who are involved in making the wheels turn in a business way and in government, also. That is a little anomalous. I'm not quite sure what to do with that one.

The Group VII occupations I call general cul-



Groups:

I. Service
II. Business Contact
III. Organization
IV. Technology
V. Outdoor
VI. Science
VII. General Cultural
VIII. Arts and Entertainment

tural. These are the occupations that are concerned with preserving and transmitting the general cultural heritage: the schoolteachers, the lawyers, the judges, the librarians, and all that general group of persons.

And finally, in Group VIII, you have the arts and entertainment occupations, a small group, but a very significant one culturally.

Now, actually, I think you can even make further breakdowns than the general suggestion that the groups mentioned come primarily from those with major orientation toward persons. I have shown these in the diagram in parentheses. For example, I think Group VIII occupations come in pretty much (see Figure) where we have this self-centered business, because here in Group VIII individuals are exploiting their own capacities of some sort or another. They may be some special talents, they may be their general physical capacity, such as a professional football player possesses—something of that sort—but it comes in this general group here.

Groups I and VII, I think, may come where I have indicated on the diagram. I put the numerals I and VIII and so forth in parentheses because the important thing is that this whole general orientation fits this general group of occupations.

Now we come to the occupations that are important to us at the moment. In this group we have occupational Groups IV, V, and VI, all deriving from those with major orientation not toward persons.

Group IV are the technological occupations. Those range from engineers at the top level, down through skilled mechanical workmen, and on down to the lathe operators. It is a large group of occupations, which is of great importance in keeping the country going.

Group V occupations are the ones on which we have the fewest psychological studies. I call them outdoor occupations, because I could not think of any other name. Included are agriculture, fisheries, mining, husbandry, all that general set of occupations. The most characteristic trait of this group is that practically no one is in it unless he was born into it—a very interesting and quite specific situation.

And finally Group VI, the general science occupations, which I have distinguished from the technological for a number of reasons, but which are also closely associated with them.

It is my belief that persons in the physical and biological sciences come from the backgrounds with family attitudes as shown in the diagram. I do not mean that every single one does, but this is our major source for recruitment. Actually, you will find that we can make a finer breakdown The Group V occupations come in primarily where I have indicated.

I think we have more Group IV on one side as shown, and more Group VI on the other, where we have more or less a defensive turning away from people. In the technological occupations we are more likely to find those who are just not interested in others, not because they are trying to get away from them, but simply because their early interests have gone through these other channels.

If this is correct, what does it signify for our problem of increasing the number of scientists?

Let me bring up the other matter of social background. Obviously, we know that the persons who become high-level scientists come predominantly from upper-class social backgrounds. This has been demonstrated repeatedly.

Why? Not because there are more accepting or rejecting homes in this group. On the contrary, the upper class are more likely to fall into overprotective or overdemanding patterns because of the values in the society for this particular sort of thing. And it is not because they are smarter, and I want to emphasize this. Look, for example, at the Army test returns on overlapping occupations. You find a great many persons at lower-level mechanical type occupations who are smart enough as far as sheer intellectual ability goes to become scientists, but who never do because it is never presented to them as a possibility.

I would submit that this particular sort of handling of children (acceptance) is more characteristic of our "lower-level" groups than it is of the upper-class group, particularly of the highly educated upper-class group that reads all the women's magazines about how to bring up your children, and so on, and is likely to get very much concerned in overconcentration on the child because of it.

This suggests to me that we have an enormous reservoir of potential scientists that we are never, never reaching. And we are not reaching them because they do not know at a time when it matters that the sort of things they like to do they can do as scientists and not as garage mechanics, or whatever it turns out to be for them.

This is only one of the implications. There are other implications, of course, for our interest in what to do when we are training them and what sort of approaches to training to make. There are some more general implications with regard to the social structure altogether.

Let me offer one caution. The fact that I divide the handling of children into three groups does not mean that I think 33 per cent of the families in the country handle their children one way, and 33 per cent another. I have no idea about the proportion falling within the three areas.

Actually, most of the studies we have had on children come from the overconcerned groups, for the simple reason that you do not get parents who are rejecting or neglecting their children into a study group. I do not mean, however, that if the parent declined to enter a study group, he was neglecting his children!

I want again to emphasize the fact that I think that it is through these patterns of family behavior that our early interests and attitudes develop, and that these interests may be implemented through an occupation. Other things being equal, these attitudes and interests determine the decision when a free decision is possible, when there is enough information available.

APPENDIX VII

Selected Bibliography of Studies Relating to the Annual Science Talent Search

SELECTED BIBLIOGRAPHY OF STUDIES

1. Edgerton, Harold A., How Science Talent Winners Were Chosen, Told by Judge, Science News Letter, July 25, 1942, 54-55.

2. Edgerton, Harold A., and Britt, Steuart Henderson, The First Annual Science Talent Search, American Scientist, January 1943, Vol. 31, No. 1.

3. Edgerton, Harold A., and Britt, Steuart Henderson, How Science Talent Search Winners Are Chosen, Science and the Future, 1943, 112-115.

4. Edgerton, Harold A., and Britt, Steuart Henderson, Further Remarks Regarding The Science Talent Search, American Scientist, 1943, Vol. 31, No. 3.

5. Edgerton, Harold A., and Britt, Steuart Henderson, The Science Talent Search, Occupations, 1943, Vol. 22, 177-180.

6. Edgerton, Harold A., and Britt, Steuart Henderson, The Third Annual Science Talent Search, Science, April 21, 1944, Vol. 99, No. 2573, 319-320.

7. Edgerton, Harold A., and Britt, Steuart Henderson, Sex Differences in the Science Talent Test, Science, September 1, 1944, Vol. 100, No. 2592, 192-193.

8. Edgerton, Harold A., and Britt, Steuart Henderson, and Davis, Helen M., Is Your State Discovering Its Science Talent?, Science Education, October 1944, Vol. 28, No. 4.

9. Edgerton, Harold A., and Britt, Steuart Henderson, Science Talent in American Youth, Science, March 1945, Vol. 101, No. 2619, 247-248.

10. Edgerton, Harold A., and Britt, Steuart Henderson, The Science Talent Search in Relation to Educational and Economic Indices, School and Society, March 9, 1946, Vol. 63, No. 1628, 172-175.

11. Edgerton, Harold A., Britt, Steuart Henderson, and Lemmon, William B., Reliability of Anecdotal Material in First Annual Science Talent Search, Journal of Applied Psychology, Vol. 31, 4, August 1947, 413-424.

12. Edgerton, Harold A., and Britt, Steuart Henderson, Some Technical Aspects of the Fourth Annual Science Talent Search, Educational and Psychological Measurement, 1947, Vol. 7, No. 1, 3-21, (Spring Issue).

13. Jessen, Margaret, A Three Year Follow-up Study of Girls Participating in the Westinghouse Science Talent Search, M.A. Thesis, Ohio State University, 1946 (Unpublished).

14. Edgerton, Harold A., and Britt, Steuart Henderson and Norman, R. D., Objective Differences Among Various Types of Respondents to a Mailed Questionnaire, American Sociological Review, XII, No. 4, August 1947, 435-444.

15. Edgerton, Harold A., Britt, Steuart Henderson and Norman, R. D., Later Achievements of Male Contestants in the First Annual Science Talent Search, American Scientist, 1948, Vol. 36, No. 3.

16. Edgerton, Harold A., and Britt, Steuart Henderson, Physical Differences Between Ranking and Non-Ranking Contestants in First Annual Science Talent Search, American Journal Physical Anthropology - N. S., Vol. 5, No. 4, December 1947, 435-452.

17. Latimer, Joseph, The Validity of Anecdotal Recommendations As Specific Factors in the Prediction of Scientific Achievement. Unpublished Ph.D. dissertation, 1948.

18. Davis, Watson, High School Science Fairs in the Fields of Mathematics and Physical Sciences, Journal of Engineering Education, October 1955, Vol. 46, No. 2.

19. Moore, Shirley, How to Build Science Talent, Today's Health, October 1957.

20. C&EN Special Report, The Young Ones Go for Science, Chemical and Engineering News, March 16, 1959, Vol. 37, No. 11.

21. Moore, Shirley, Raising a Future Scientist, Science News Letter, August 29, 1959, Vol. 76, No. 9.

22. Science Talent Search Light, Science Service, Vol. 1-9.

23. Moore, Shirley, Young Scientists' Development, The Science Counselor, March 1959, Vol. XXII, No. 1.

APPENDIX IV

Tables Referred to in Section IV

Table IV-1
to
Table IV-5
Inclusive

TABLE IV-1

Number of Questionnaires Mailed and Number Returned

	Men			Women			Total		
Contest Status	Sent	Returned	Per Cent	Sent	Returned	Per Cent	Sent	Returned	Per Cent
Winners	60	46	74	20	17	85	80	63	78
Honorable Mentions	238	148	64	80	40	49	318	188	58
Others	3731	1040	28	1201	259	21	4932	1299	26
TOTAL	4029	1234	31	1301	316	24	5330	1550	29

TABLE IV-2

Distribution of Science Aptitude Examination Scores (Errors)**
STS-1 GROUP

	Participants In This Study			
Scores (Errors)	Male Honors*	Male Others	Female Honors*	Female Others
0- 4	4	4	--	--
5- 9	37	27	6	1
10-14	54	36	9	4
15-19	--	99	13	3
20-24	--	82	2	14
25-29	--	71	--	20
30-34	--	51	--	22
35-39	--	39	--	11
40-44	--	17	--	5
45-49	--	13	--	6
50-54	--	8	--	3
55-59	--	7	--	1
60-64	--	2	--	2
65-69	--	2	--	1
70-74	--	--	--	--
No Data	2	3	1	1
TOTAL	97	461	31	94

* The Honors Group is made up of both Winners and Honorable Mentions. This combination is used so as to reduce sampling error due to small numbers.

** Scores are shown as errors; the lower the score, the higher the quality of test performance.

TABLE IV-3

Distribution of Science Aptitude Examination Scores
STS-2 GROUP

Participants In This Study

Scores (Errors)	Male Honors	Male Others	Female Honors	Female Others
15-19	--	1	--	--
20-24	--	2	--	--
25-29	8	4	--	--
30-34	14	11	1	1
35-39	20	19	2	--
40-44	35	29	6	6
45-49	18	75	7	8
50-54	--	106	9	14
55-59	--	114	--	32
60-64	--	101	--	46
65-69	--	69	--	33
70-74	--	30	--	18
75-79	--	9	--	5
80-84	--	1	--	1
85-89	--	1	--	1
No Data	2	7	--	1
TOTAL	97	579	25	166

TABLE IV-4

Relative Standing in High School Graduating Class of Those Who Answered the Questionnaire

Percentile Rank In H. S. Class	Males		Females	
	Honors	Others	Honors	Others
100	67	62	31	23
99	47	53	12	28
98	23	69	8	18
96-97	22	81	5	23
91-95	11	209	--	56
81-90	4	153	--	34
71-80	1	101	--	23
61-70	--	50	--	1
51-60	--	21	--	--
50 & lower	--	44	--	5
No Data	9*	197	--	49
TOTAL	194	1040	56	260

* High School standing not available as rank and number in graduating class, but shown as a transcript of grades.

TABLE IV-5

Numbers of Interviewees According to Science Aptitude Examination Score* (Errors)

Test Score	1942				1943			
	Male		Female		Male		Female	
(Errors)	H	O	H	O	H	O	H	O
0- 9	11	2	2	--	--	--	--	--
10-19	12	11	6	--	--	--	--	--
20-29	--	9	--	4	4	2	--	--
30-39	--	4	--	4	10	1	3	--
40-49	--	2	--	--	9	6	3	1
50-59	--	--	--	--	--	10	1	3
60-69	--	--	--	--	--	8	1	1
70-79	--	--	--	--	--	--	--	1
80-89	--	--	--	--	--	--	--	1
No Score	1	--	--	--	1	1	--	--
TOTAL	24	28	8	8	24	29	8	7

* The scores for STS-1 and STS=2 are not comparable.

APPENDIX V

Tables Referred to in Section V

Table V-1
to
Table V-14
Inclusive

TABLE V-1

Science Aptitude Examination Score (Errors) According to Highest Degree Obtained (STS-1)

Test Score (Errors)		None		Certificate RN, AA		Bachelor		Master		Med Doctorates		Other Med Doctorates		PhD & Other Doctorates		TOTAL	
		M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
0-9	H	--	1	--	--	8	3	8	--	6	1	--	--	19	1	41	6
	O	2	--	--	--	12	1	5	--	2	--	--	--	10	--	31	1
10-9	H	1	3	--	--	21	12	15	3	7	1	--	--	10	3	42	22
	O	9	--	1	--	64	3	34	3	16	--	--	--	11	1	135	7
20-9	H	--	1	--	--	--	1	--	--	--	--	--	--	--	--	--	2
	O	13	9	1	1	77	20	31	4	17	--	4	--	10	--	153	34
30-9	H	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	O	13	8	2	4	40	17	13	5	11	--	3	--	8	--	90	33
40-9	H	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	O	10	3	--	2	15	6	2	--	2	--	--	--	1	--	30	11
50-9	H	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	O	6	2	--	1	7	1	2	--	--	--	--	--	--	--	15	4
60-9	H	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	O	2	2	--	--	--	1	--	--	--	--	2	--	--	--	4	3
No Data*	H	--	--	--	--	--	1	2	--	--	--	--	--	1	--	2	1
	O	1	--	--	--	1	1	--	--	--	--	--	--	1	--	3	1
TOTAL	H	1	5	--	--	29	17	25	3	13	2	--	--	30	4	97	31
	O	56	24	4	8	216	50	87	12	48	--	9	--	41	1	461	94
Means		32.6	32.4	24.5	38.3	23.1	26.6	19.8	24.5	20.6	9.5	36.7	--	14.5	12.5	22.3	27.6

* Science Aptitude Examinations not available in the files.

TABLE V-2

Science Aptitude Examination Score (Errors) According to Highest Degree Obtained (STS-2)

Test Score (Errors)		None		Certificate RN, AA		Bachelor		Master		Med Doctorates		Other Med Doctorates		PhD & Other Doctorates		TOTAL	
		M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
0-9	H	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	O	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
10-9	H	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	O	--	--	--	--	--	--	--	--	1	--	--	--	--	--	1	--
20-9	H	--	--	--	--	4	--	2	--	--	--	--	--	2	--	8	--
	O	--	--	--	--	1	--	1	--	--	--	--	--	4	--	6	--
30-9	H	2	--	--	--	7	--	6	1	6	--	--	--	13	2	34	3
	O	1	--	1	--	10	--	7	--	3	--	1	--	7	1	30	1
40-9	H	1	--	--	--	12	9	17	2	4	2	--	--	18	1	53	13
	O	7	1	1	1	43	8	21	2	21	1	--	--	11	1	104	14
50-9	H	--	--	--	--	--	7	--	1	--	1	--	--	--	--	--	9
	O	26	8	4	3	90	26	47	7	25	2	4	--	24	--	220	46
60-9	H	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	O	32	25	2	5	82	39	28	7	11	2	5	--	10	1	170	79
70-9	H	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	O	10	4	1	1	20	14	4	3	1	--	2	--	1	1	39	23
80-9	H	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	O	--	1	--	--	2	--	--	1	--	--	--	--	--	--	2	2
No Data*	H	--	--	--	--	1	--	1	--	--	--	--	--	--	--	2	--
	O	--	--	--	--	6	1	--	--	--	--	--	--	1	--	7	1
TOTAL	H	3	--	--	--	24	16	26	4	10	3	--	--	33	3	97	25
	O	76	39	9	10	254	88	108	20	62	5	12	--	58	4	579	166
Means		59.3		54.5		55.4		51.7		49.8		60.3		46.2		53.3	
			63.5		60.5		59.5		57.5		53.3		--		47.4		59.4

* Science Aptitude Examinations not available in files.

TABLE V-3

Mean Scores (Errors) for Males on the Science Aptitude Examination According to Present Field

Present Field	Mean Scores (Errors) STS-1	Mean Scores (Errors) STS-2
Biological Sciences	29.0 (20)*	51.5 (20)
Engineering	29.7 (157)	52.2 (184)
Other Medical Sciences	28.2 (21)	57.1 (23)
Medicine	23.3 (64)	49.8 (72)
Chemistry	18.6 (31)	33.7 (36)
Physics	12.3 (27)	43.5 (31)
Other Sciences	-- --	52.0 (12)
Mathematics	19.5 (12)	43.5 (10)
Non-Sc, Mgr/Prof	22.6 (161)	55.8 (204)
Non-Sc, Other	30.6 (35)	59.6 (53)
All	23.3 (528)	53.3 (645)
F ratio	4.992	8.167

* Indicates the number of cases used in computing the mean.

TABLE V-4

Mean Test Scores (Errors) According to Field Chosen as a High School Senior

Choice of Field	STS-1		STS-2	
	Male	Female	Male	Female
Biological Sciences	28.6	35.5	56.6	60.7
Engineering	22.1	--	52.2	--
Other Medical Sciences	--	23.8	--	60.9
Medicine	24.7	--	53.2	57.5
Other Physical Sciences	--	--	--	--
Chemistry	19.4	22.2	54.3	58.5
Physics	17.5	--	47.8	--
Other Sciences	--	--	--	--
Mathematics	--	--	--	--
Non-Sc, Mgr/Prof	--	--	56.6	60.9
Non-Sc, Other	--	--	--	--
No Data	23.9	26.7	54.6	60.3

TABLE V-5

Relationship of Highest Academic Degree to Choice of Field as a High School Senior

Highest Academic Degree Received

Choice of Field as HS 12th Grade		None		Certificate		Bachelors		Masters		MD		Other Medical Doctorate		Ph.D.		Sc.D.		Other Doctorate		Per Cent Having Doctorate Degrees	TOTAL	
		M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F		M	F
Bio Sc	H	--	1	--	--	--	1	1	--	--	--	--	--	4	1	--	--	--	--	30%	5	3
	O	9	8	--	--	11	10	8	--	6	--	4	--	4	1	--	--	--	1		42	20
Engrg	H	1	--	--	--	32	2	28	1	4	--	--	--	18	--	1	--	1	--	14%	85	3
	O	49	3	7	--	251	3	96	1	17	--	3	--	31	--	1	--	1	--		456	7
Other Med Sc	H	--	1	--	--	--	1	--	--	1	1	--	--	--	--	--	--	--	--	16%	1	3
	O	4	14	--	11	3	19	1	4	--	1	6	--	--	2	--	--	--	--		14	51
Med	H	--	--	--	--	--	6	1	--	10	2	--	--	2	--	--	--	--	--	58%	13	8
	O	5	7	--	4	22	12	8	2	64	3	4	--	7	--	--	--	--	--		110	28
Other Phys Sc	H	--	--	--	--	--	1	1	--	--	1	--	--	2	--	--	1	--	--	29%	3	3
	O	3	--	--	--	6	1	4	1	--	--	--	--	3	--	--	--	--	--		16	2
Chem	H	-	1	--	--	9	11	7	2	5	--	--	--	12	3	--	--	--	--	24%	34	17
	O	15	5	1	--	55	32	26	6	9	--	--	--	22	--	2	--	--	--		130	43
Physics	H	--	--	--	--	3	2	3	--	--	--	--	--	10	1	--	--	--	--	36%	16	3
	O	5	2	--	--	11	1	14	--	2	--	2	--	8	--	--	--	--	--		42	3
Other Sc	H	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0%	--	--
	O	--	1	--	--	2	13	--	3	--	--	--	--	--	--	--	--	--	--		2	17
Math	H	--	--	--	--	--	--	--	--	--	--	--	--	2	--	--	--	--	--	42%	2	--
	O	2	--	--	--	4	--	1	--	--	--	--	--	3	--	--	--	--	--		10	--
Non-Sc Mgr/Prof	H	--	--	--	--	--	2	2	--	--	--	--	--	--	--	--	--	--	--	7%	2	2
	O	2	8	--	1	19	18	15	4	2	--	--	--	2	--	--	--	1	--		41	31
Non-Sc Other	H	--	--	--	--	1	--	--	--	--	--	--	--	1	--	--	--	--	--	5%	2	--
	O	3	3	3	--	5	3	--	--	--	--	--	--	--	--	--	--	--	--		11	6
No Data	H	3	2	--	--	8	7	7	4	3	1	--	--	10	1	--	--	--	--	16%	31	14
	O	35	12	2	2	81	26	22	11	10	1	2	--	14	--	--	--	--	--		166	52
TOTAL	H	4	5	--	--	53	33	50	7	23	5	--	--	61	6	1	1	1	--		194	56
	O	132	63	13	18	470	138	195	32	110	5	21	--	94	3	3	--	2	1		1040	260
Percents*	H	2	11	--	2	27	57	26	12	12	7	--	--	31	11	1	--	1	--			
	O	12	24	1	11	45	50	19	12	11	2	2	--	9	1	--	--	--	--			

* This may be read as follows: 2% of the Male Honors group had no college degree at all, while 27% had a Bachelor's Degree as their highest degree, etc.

TABLE V-6

Average Size of High School Graduating Class According to Present Field (Men)

Present Field	Mean Class Size	
Biological Sciences	157	(35)*
Engineering	187	(309)
Other Medical Sciences	181	(42)
Medicine	185	(124)
Other Physical Sciences	129	(17)
Chemistry	164	(64)
Physics	200	(53)
Other Sciences	259	(17)
Mathematics	218	(22)
Non-Sc, Mgr/Prof	124	(325)
Non-Sc, Other	101	(75)
No Data	154	(13)
TOTALS	161	
F ratio	3.085	

* Numbers in parentheses refer to number of cases.

TABLE V-7

Relationship of Original Choice of Field to Present Field

Present Field of Interest

		1.		2.		3.		4.		5.		6.		7.		8.		9.		10.		11.		12.		13.		ND		Total	
		M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
1. Bio	H	1	--	--	--	1	--	--	--	1	--	1	--	--	--	--	--	--	--	--	--	--	--	1	--	--	3	--	--	5	3
Sc	O	8	2	2	--	7	--	6	--	--	--	1	--	--	--	2	--	1	--	--	--	10	2	5	3	--	10	--	3	42	20
2. Engrg	H	--	--	37	--	--	--	5	--	--	--	5	--	7	1	--	--	2	--	2	--	24	--	3	--	--	2	--	--	85	3
	O	2	--	204	--	4	--	19	--	5	--	12	--	11	--	5	--	8	--	1	--	145	3	33	1	--	2	7	1	456	7
3. Other	H	--	--	--	--	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	--	--	--	1	--	--	1	3
Med Sc	O	1	--	--	--	8	15	--	1	--	--	--	--	--	--	--	--	--	1	--	--	3	--	2	3	--	22	--	9	14	51
4. Med	H	1	--	--	--	--	1	10	1	--	--	--	--	1	--	--	--	--	1	--	--	1	1	--	--	--	4	--	--	13	8
	O	4	1	5	--	8	2	66	3	--	--	3	1	--	--	3	--	1	--	--	--	17	3	3	2	--	14	--	2	110	28
5. Other	H	--	--	--	--	--	--	--	1	--	--	--	--	1	1	--	--	--	--	--	--	2	--	--	--	--	1	--	--	3	3
Phys Sc	O	--	--	2	--	--	--	--	--	3	--	2	--	2	--	--	--	--	--	--	--	6	--	1	--	--	2	--	--	16	2
6. Chem	H	--	--	7	--	2	--	4	1	--	--	11	--	1	--	--	1	1	--	--	--	8	3	--	--	--	12	--	--	34	17
	O	10	--	20	1	4	2	9	--	1	--	22	5	9	--	2	1	1	--	--	--	42	7	8	4	--	18	2	5	130	43
7. Physics	H	--	--	3	--	--	--	--	--	1	1	3	--	6	--	--	--	--	--	1	--	2	--	--	--	--	2	--	--	16	3
	O	3	--	[illegible]	--	2	1	2	--	4	--	2	--	8	--	1	--	2	--	--	--	9	--	2	--	--	2	--	--	42	3
8. Other	H	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sc	O	--	--	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	4	--	--	--	11	--	--	2	17
9. Math	H	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	--	--	--	1	--	--	--	--	--	--	--	2	--
	O	--	--	2	--	--	--	--	--	1	--	--	--	--	--	--	--	1	--	1	--	3	--	1	--	--	--	1	--	10	--
10. Science	H	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
(NEC)	O	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
11. Non-Sc	H	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2	--	--	--	--	2	--	--	2	2
Mgr/Prof	O	--	--	8	--	--	2	2	--	--	--	2	1	--	--	--	1	--	--	--	--	27	7	2	3	--	14	--	3	41	31
12. Non-Sc	H	--	--	1	--	--	--	--	--	--	--	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2	--
Other	O	--	--	2	--	1	--	--	--	--	--	--	--	1	--	1	--	--	--	--	--	2	1	3	3	--	2	1	--	11	6
13. Home-	H	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
maker	O	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
No Data	H	1	--	6	--	--	--	3	0	1	--	2	1	5	--	1	--	1	--	2	--	9	1	--	1	--	11	--	--	31	14
	O	9	1	36	--	6	6	10	1	1	--	5	1	6	--	2	--	4	1	--	--	57	9	27	2	--	24	3	7	166	52
TOTALS	H	3	--	54	--	4	1	22	4	3	1	23	1	21	2	1	1	5	1	5	--	49	6	4	1	--	38	1	--	194	56
	O	37	4	289	1	40	28	114	5	15	--	49	8	37	--	17	4	18	2	2	--	321	36	87	21	--	121	14	30	1040	260

TABLE V-8

Kind of Work

		Student		Research Director		Research		Research Associate		Adm/Mgt		Practicing		Teaching		Design		Sales		NEC		No Data		TOTAL	
Present Field		M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Bio	H	--	--	--	--	--	--	--	--	--	--	--	--	3	--	--	--	--	--	--	--	--	--	3	--
Sc	O	1	--	1	--	2	--	--	1	--	--	22	2	11	1	--	--	--	--	--	--	--	--	37	4
Engrg	H	--	--	--	--	2	--	6	--	2	--	38	--	3	--	1	--	2	--	--	--	--	--	54	--
	O	--	--	1	--	13	--	11	1	12	--	226	--	2	--	15	--	9	--	--	--	--	--	289	1
Other	H	--	--	--	--	--	--	1	--	--	--	1	1	2	--	--	--	--	--	--	--	--	--	4	1
Med Sc	O	--	--	--	--	--	--	3	1	--	2	33	22	3	2	--	--	1	--	--	1	--	--	40	28
Med	H	2	--	--	--	1	--	1	--	1	--	15	4	1	--	--	--	1	--	--	--	--	--	22	4
	O	5	--	2	--	5	--	1	--	2	--	91	4	8	--	--	--	--	--	--	1	--	--	114	5
Other	H	--	--	--	--	--	--	--	1	--	--	--	--	3	--	--	--	--	--	--	--	--	--	3	1
Phys Sc	O	--	--	1	--	1	--	1	--	--	--	9	--	3	--	--	--	--	--	--	--	--	--	15	--
Chem	H	--	--	1	--	7	--	3	--	--	--	8	--	4	1	--	--	--	--	--	--	--	--	23	1
	O	--	--	--	--	10	1	11	--	3	--	21	7	4	--	--	--	--	--	--	--	--	--	49	8
Physics	H	--	--	--	--	8	1	--	1	--	--	7	--	6	--	--	--	--	--	--	--	--	--	21	2
	O	1	--	--	--	9	--	1	--	--	--	19	--	7	--	--	--	--	--	--	--	--	--	37	--
Other	H	--	--	--	--	--	--	--	--	--	--	1	--	--	1	--	--	--	--	--	--	--	--	1	1
Sc	O	--	--	--	--	2	--	1	--	2	--	9	3	3	1	--	--	--	--	--	--	--	--	17	4
Math	H	--	--	--	--	--	--	--	--	--	--	2	1	3	--	--	--	--	--	--	--	--	--	5	1
	O	--	--	--	--	1	--	--	--	1	--	9	--	7	2	--	--	--	--	--	--	--	--	18	2
Home-	H	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	38	--	--	--	38
maker	O	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	121	--	--	--	121
Non-Sc	H	--	--	1	--	1	--	--	--	13	--	25	5	4	--	--	--	5	1	--	--	--	--	49	6
Mgr/Prof	O	2	--	--	--	1	--	2	1	65	2	179	16	40	16	2	--	29	--	1	1	--	--	321	36
Non-Sc	H	--	--	--	--	--	--	--	--	--	--	4	1	--	--	--	--	--	--	--	--	--	--	4	1
Other	O	--	--	--	--	--	--	--	1	--	--	68	18	--	--	2	--	13	1	3	1	1	--	87	21
Science	H	--	--	--	--	2	--	--	--	--	--	1	--	1	--	1	--	--	--	--	--	--	--	5	--
(NEC)	O	--	--	--	--	--	--	1	--	--	--	--	--	1	--	--	--	--	--	--	--	--	--	2	--
No Data	H	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	O	3	--	--	--	3	--	--	--	--	--	3	--	--	--	--	--	--	--	--	--	5	30	14	30
TOTAL	H	2	--	2	--	21	1	11	2	16	--	102	12	30	2	2	--	8	1	--	38	--	--	194	56
	O	12	--	5	--	46	1	32	5	85	4	689	72	89	22	19	--	52	1	4	125	6	30	1040	260
Per Cents*	H	1	--	1	--	11	2	6	5	8	--	53	21	15	4	1	--	4	2	--	68	--	--		
	O	1	--	1	--	4	--	3	2	8	2	67	31	9	10	2	--	5	--	--	54	--	--		

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* This may be read as follows: e.g., 1% of the Male Honors group are students, 1% are Research Directors, etc.

TABLE V-9

Kind of Employer

		Univ/ College		HS		Elem School		Non-profit		Business/ Industry		Govt		Military		Self		NEC		No Data		TOTAL	
Present Field		M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Bio	H	3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3	--
Sc	O	10	--	3	1	--	--	2	1	3	--	4	1	--	--	15	--	--	--	--	1	37	4
Engrg	H	8	--	--	--	--	--	--	--	43	--	2	--	1	--	--	--	--	--	--	--	54	--
	O	10	1	--	--	--	--	5	--	247	--	9	--	13	--	4	--	1	--	--	--	289	1
Other	H	2	1	--	--	--	--	1	--	--	--	--	--	--	--	1	--	--	--	--	--	4	1
Med Sc	O	6	3	--	--	--	--	4	9	8	12	2	3	1	--	19	--	--	1	--	--	40	28
Med	H	2	--	--	--	--	--	2	--	2	--	3	1	2	--	11	3	--	--	--	--	22	4
	O	18	2	--	--	--	--	16	1	1	--	7	--	3	--	69	1	--	1	--	--	114	5
Other	H	3	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3	1
Phys Sc	O	6	--	--	--	--	--	--	--	6	--	2	--	--	--	1	--	--	--	--	--	15	--
Chem	H	6	1	--	--	--	--	--	--	15	--	2	--	--	--	--	--	--	--	--	--	23	1
	O	8	1	--	--	--	--	--	1	39	6	1	--	1	--	--	--	--	--	--	--	49	8
Physics	H	7	--	1	--	--	--	--	--	10	--	2	2	1	--	--	--	--	--	--	--	21	2
	O	11	--	1	--	--	--	--	--	17	--	2	--	6	--	--	--	--	--	--	--	37	--
Other	H	--	1	--	--	--	--	--	--	--	--	1	--	--	--	--	--	--	--	--	--	1	1
Sc	O	5	2	3	1	--	--	1	1	4	--	4	--	--	--	--	--	--	--	--	--	17	4
Math	H	3	--	--	--	--	--	--	--	2	1	--	--	--	--	--	--	--	--	--	--	5	1
	O	6	--	2	1	--	--	--	--	9	1	1	--	--	--	--	--	--	--	--	--	18	2
Home-	H	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	38	--	--	--	38
maker	O	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	121	--	--	--	121
Non-Sc	H	4	1	2	--	2	--	2	1	28	3	4	1	4	--	3	--	--	--	--	--	49	6
Mgr/Prof	O	14	5	23	5	9	10	19	6	157	5	12	1	40	1	44	2	1	1	2	--	321	36
Non-Sc	H	--	--	--	--	--	--	--	--	1	1	1	--	--	--	2	--	--	--	--	--	4	1
Other	O	1	1	--	--	--	1	--	2	62	14	4	1	3	--	15	2	1	--	1	--	87	21
Science	H	1	--	--	--	--	--	1	--	3	--	--	--	--	--	--	--	--	--	--	--	5	--
(NEC)	O	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2	--
No Data	H	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	O	3	--	--	--	--	--	--	--	1	--	--	--	--	--	5	--	--	--	5	30	14	30
TOTAL	H	39	5	3	--	2	--	6	1	104	5	15	4	8	--	17	3	--	38	--	--	194	56
	O	100	15	32	8	9	11	47	21	554	38	48	6	67	1	172	5	3	124	8	31	1040	260

TABLE V-10

Highest Degree Received According to Present Field of Interest

Highest Degree

Present Field of Interest		None (No Data)		Certificate RN, AA		Bachelor		Master		MD & Other Med Doctorates		PhD & Other Doctorates		Per Cent Having Doctor's Degree		TOTAL	
		M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Bio Sc	H	--	--	--	--	--	--	--	--	--	--	3	--	100	--	3	--
	O	10	--	--	--	8	1	6	2	--	--	13	1	35	25	37	4
Engrg	H	--	--	--	--	21	--	24	--	--	--	9	--	17	--	54	--
	O	13	--	4	--	185	1	74	--	1	--	12	--	4	--	289	1
Med	H	--	--	--	--	1	--	--	--	21	4	--	--	95	100	22	4
	O	--	--	--	--	2	--	1	--	111	5	--	--	97	100	114	5
Other Med Sc	H	--	--	--	--	--	1	--	--	2	--	2	--	100	--	4	1
	O	2	4	2	8	9	15	2	--	19	--	6	1	63	4	40	28
Chem	H	--	--	--	--	5	--	2	1	--	--	16	--	70	--	23	1
	O	3	1	--	--	16	4	5	3	--	--	25	--	51	--	49	8
Physics	H	--	--	--	--	1	--	2	1	--	--	18	1	86	50	21	2
	O	--	--	--	--	11	--	[illegible]	--	--	--	18	--	49	--	37	--
Other Phy Sc	H	--	--	--	--	--	--	--	--	--	--	3	1	100	100	3	1
	O	--	--	--	--	4	--	7	--	--	--	4	--	26	--	15	--
Math	H	--	--	--	--	--	1	1	--	--	--	4	--	80	--	5	1
	O	--	--	--	--	11	1	4	1	--	--	3	--	17	--	18	2
Other Sc	H	--	--	--	--	1	--	--	--	--	--	--	1	--	--	1	1
	O	1	--	--	--	5	3	3	1	--	--	8	--	47	--	17	4
Science (NEC)	H	--	--	--	--	--	--	--	--	--	--	5	--	100	--	5	--
	O	--	--	--	--	--	--	1	--	--	--	1	--	50	--	2	--
Non-Sc Mgr/Prof	H	4	1	--	--	21	4	20	2	--	--	3	--	6	--	49	6
	O	47	4	2	--	189	21	75	10	--	--	8	1	2	3	321	36
Non-Sc Other	H	--	1	--	--	3	--	1	--	--	--	--	--	--	--	4	1
	O	53	12	4	1	27	7	3	1	--	--	--	--	--	--	87	21
Homemaker	H	--	3	--	--	--	27	--	3	--	1	--	4	--	13	--	38
	O	--	33	--	5	--	68	--	14	--	--	--	1	--	1	--	121
No Data	H	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	O	3	9	--	4	3	17	6	--	--	--	1	--	8	--	13	30
TOTAL	H	4	5	--	--	53	33	50	7	23	5	63	7	--	--	194	56
	O	132	63	13	18	470	138	195	32	131	5	99	4	--	--	1040	260

TABLE V-11

Time Spent in Military Service

Months in Service	Men Honors	Men Others	Total
96 & above	11	48	59
84 - 93	1	2	3
72 - 83	--	14	14
60 - 71	4	23	27
48 - 59	4	38	42
36 - 47	41	185	226
24 - 35	80	432	512
12 - 23	19	136	155
1 - 11	5	20	25
None*	29	142	171
TOTAL	194	1040	1234

* Includes No Data

TABLE V-12

Per Cents of Men Who Served as Officers by Present Field of Interest

Present Field	Number in Service	Per cent in Service	% of those in Service who were Officers
Biological Sciences	28	70%	28%
Engineering	314	92	32
Other Medical Sciences	43	98	26
Medicine	129	94	69
Other Physical Sciences	18	100	33
Chemistry	54	75	17
Physics	47	81	32
Other Sciences	15	83	20
Mathematics	19	83	21
Non-Sc., Mgr/Prof	327	88	42
Non-Sc., Other	69	76	22
TOTAL	1063		

TABLE V-13

Martial Status of Those Who Returned Questionnaires

Marital Status	Men Honors	Men Others	Total Men	Women Honors	Women Others	Total Women
Single	24	137	161	11	51	62
Married	165	884	1049	45	202	247
Widowed	4	4	8		2	2
Divorced	1	13	14		4	4
No Data		2	2		1	1
TOTAL	194	1040	1234	56	260	316

TABLE V-14

Number of Non-Single Respondents According to Number of Children Reported

Number of Children	Men Honors	Men Others	Total Men	Women Honors	Women Others	Total Women
0	19	134	153	3	31	34
1	35	167	202	9	36	45
2	56	312	368	12	57	69
3	35	190	225	15	49	64
4	19	76	95	6	26	32
5	5	16	21		7	7
6		4	4		1	1
7	1	1	2		2	2
8						
9 or more		1	1			
TOTAL	170	901	1071	45	209	254

APPENDIX VI

Tables Referred to in Section VI

Table VI-1

TABLE VI-1

Numbers of Interviewees According to Present Occupational Field

	Men		Women	
Present Field	Honors	Others	Honors	Others
Medicine, Private Practice	7	4	2	1
Medical Research	4	7	-	-
Industrial Management	8	5	-	2
College Professors	10	4	1	-
High School Teachers	-	4	-	-
Research, Government	1	3	3	-
Research, Industrial	8	4	-	3
Director of Research	2	2	-	-
Patent Attorney	-	3	-	-
Engineering	2	7	-	-
Military	-	4	-	-
Non-Science, Degree	6	5	1	4
Non-Science, No Degree	-	5	1	2
Homemaker	-	-	8	3
TOTAL	48	57	16	15

SCIENCE SERVICE PUBLICATIONS

The following publications are recommended for reference about the Science Talent Search for the Westinghouse Science Scholarships and Awards and other information.

How You Can Search for Science Talent—Free.

Honors Group in the 20th Annual Science Talent Search for the Westinghouse Science Scholarships and Awards—Free.

Science Aptitude Examinations (Ninth, Fourteenth, Sixteenth, Eighteenth, Nineteenth and Twentieth available) Postpaid 15¢ per copy.

Color Slides—Set VI: **The Science Talent Search**—Winners in the 18th Science Talent Search enjoy 5 intensive days of scientific trips, discussions, judging sessions and final presentation of the Westinghouse Science Scholarships and Awards. Set of 30 (2" x 2") slides. $6.00 per set.

Science Projects Handbook—Includes a variety of successful projects done by winners and members of the Honors Group in the Science Talent Search. Postpaid 55¢ each, 10 copies $5.00.

Thousands of Science Projects—Classified titles of exhibits shown at Science Fairs and/or produced as projects for the Annual Science Talent Search. Postpaid 25¢ each, 10 for $1.00.

Chemistry—Pocket-size magazine devoted to the simplification of technical chemistry. Some issues carry project reports of the Honors Group of the Science Talent Search (8 issues—September through April) $4.00 per year.

Science News Letter—(weekly publication)—$5.50 per year.